FERTILITY TRENDS AND DIFFERENTIALS IN
CENTRAL ETHIOPIA

BY

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ABSTRACT

Official fertility estimates in Ethiopia show that fertility is high and varies regionally. However, the causes and correlates are not well understood.

This thesis investigates the levels, trends and differentials of fertility in two administrative regions, Arsi and Shoa in Central Ethiopia using data from the Population, Health and Nutrition Project baseline survey conducted by the Ministry of Health in 1986. It also provides the socio-economic and demographic explanations of high fertility in these regions.

The thesis examines data limitations and identifies the types and sources of error. Missing, incomplete or inconsistent dates in the birth history are imputed and the validity of the data for fertility studies is assessed.

Indirect demographic techniques and period-cohort analysis of birth histories are used for estimating fertility trends, and multivariate analysis is applied for examining fertility differentials.

The population is shown to have high and rising fertility. Total fertility increased from about six children per woman around 1970 to about eight children in the early 1980s. Most of this increase occurred between 1977 and 1982. Significant rural-urban, religious and ethnic differentials are also observed. Early and universal marriage, high infant and child mortality, pro-natal cultural and religious values, low levels of infertility and the absence of birth control methods are investigated as possible explanations for the fertility patterns. Change in marital fertility brought about by the decline in the duration and intensity of breastfeeding and increase in exposure to the risk of childbearing through reduced spousal separation are identified as the major causes of the recent rise, while variations in breastfeeding patterns, infant and child mortality and stability of marriage rather than differences in contraceptive use appear to explain most of the observed differentials.

The study concludes by identifying methodological problems and needs for future research. The implications of the study are underscored with specific policy recommendations.

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CHAPTER I

INTRODUCTION

The revolution in mortality that was brought about by improvements in personal hygiene, environmental sanitation, medical technology, education and nutrition among others had led to rapid declines in mortality in many of the developing countries. For instance, the crude death rate declined from 21 per 1000 to 15 per 1000 for all low income countries excluding China and India between 1965 and 1985 (World Bank, 1987a). Although some changes in fertility had also occurred in some of these countries, the overall change was marginal. The crude birth rate declined just by 3 points (from 46 to 43 per 1000) during this period in these countries. In fact in most of the low income countries, fertility remained unchanged and in some, the decline in mortality was followed by a fertility rise. For instance, Dyson and Murphy (1986) document the wide-spread increase in developing country fertility levels prior to the recent sharp declines.

The decline in mortality coupled with high and some times rising fertility led to a dramatic increases in the populations of these countries. The rate of growth of the populations of the developing countries now stands at about 2 per cent per annum with a country range from 1 per cent to about 4 per cent. Most of the countries of Sub-Saharan Africa show a growth of over 3 per cent (World Bank, 1987a).

Population growth, especially if it does not out-strip the growth of savings, investment, food production, etc., may contribute to economic development. It may reduce the cost and increase the benefit of investment in transport, communication and markets, and in the rural areas, in irrigation, agricultural extension services and the provision of social services such as in education and health. However, in the absence of sufficient capital, skilled managerial know-how and technical improvements, it may be a problem. In Sub-Saharan Africa, population growth is much faster than the growth of complementary resources. Moreover, poverty and its associated low levels of education and health, weak infrastructure and a weak human resource base contributed to a situation of no economic growth and some times a relative decline of complementary resources in most countries. Consequently, rapid population growth has become an increasing social, economic and environmental problem. Demand on health and educational services is increasing while savings, investment and per capita labour productivity are declining. Urbanization and unemployment are growing and the general standard of living of the population is deteriorating. Land fragmentation, soil erosion, deforestation and depletion of resources are occurring much faster in Sub-Saharan Africa than anywhere else in the developing world today (World Bank, 1984).

During the demographic transition in today's developed countries, the growth in population that resulted from declining mortality and lagging fertility was mitigated by a number of factors which included late marriage, celibacy and in some cases external migration. For most of today's developing countries particularly those in Sub-Saharan Africa, however, out-migration possibilities are slim; marriage is early and universal; strong cultural and religious values that favour high fertility are still persistent; a conducive atmosphere for the wide-spread use of contraception has not yet been created and abortion is illegal. On the other hand, the traditional norms and values of birth spacing (breastfeeding and abstinence) are gradually fading away leading to shorter birth intervals which in turn lead to higher number of births per woman. Moreover, the low cost of raising children, their importance as a source of household labour and the support they provide at old age to parents make children a valuable asset. Consequently, fertility has been and remains high in Sub-Saharan Africa.

Fertility is the most dynamic element in determining the size, rate of growth, distribution in space and the age structure of a population. In the absence of substantial migration, at any given level of mortality, changes in fertility cause variations in the rates of natural increase and exert a powerful influence on the age structure of a population (UN, 1954). Bogue (1971) noted that fertility is a major expansionary force in population dynamics and a major counteracting force to population attrition through mortality. Fertility is also a vital factor in the determination of the social, economic and political features of a nation.

Increasing awareness of this fact has in recent years produced an ever increasing number of demographic and related studies having as their primary purpose, some aspect of human fertility including its levels, trends and differentials. This has resulted in a rigorous and coherent set of basic concepts and workable definitions for measuring fertility. Large quantities of general descriptive and historical information about fertility changes over time, and differentials over parts of the population of the world have been accumulated and ingenious mathematical models capable of simulating fertility processes have been developed (Brass, 1964, 1968, 1974; Perria and Sheps, 1964; Coale and Trussell, 1974; Potter and Parks 1964; Bongaarts, 1976; 1978).

Thanks to the World Fertility Survey and other similar surveys, dramatic progress has been made in the collection, analysis and interpretation of data pertaining to human reproductive behaviour for most countries of the world.

However, there are still major countries mostly in Sub-Saharan Africa for which there is no reliable information about the levels, trends and differentials of fertility as well as other demographic parameters. Ethiopia is one of these Sub-Saharan African countries for which information on fertility and mortality have been rare. Vital registration is virtually absent and data from periodic surveys are not widely available.

Some of the reasons for the lack of demographic information in the country are : (i) the general neglect and unawareness of the use of demographic data in socio-economic planning, (ii) the inadequate transportation system and the difficult terrain of the country that makes most parts not easily accessible, and (iii) the lack of operational resources and technical and managerial skills in the design and execution of surveys. In addition, civil wars, and the widely dispersed nomadic population made the collection of demographic data in the country particularly difficult. As a result, estimates of the size of the population, its growth rates and other demographic indicators were based on often inaccurate, incomplete and inconsistent data obtained from travellers' accounts and/or head counts made for administrative purposes until the mid 1960s. However, with the establishment of the Central Statistical Office, (C.S.O.) in 1964, conditions improved slightly and three surveys were conducted between 1964 and 1981. Also the first census ever was taken in 1984 but results have not yet (late 1989) been tabulated for all regions.

Between 1964 and 1971, two rounds of multi-purpose national sample surveys were conducted. National Sample Survey First Round (NSS1) was conducted between 1964 and 1967. It covered 83 per cent of the rural areas and 92 per cent of the urban areas (195 towns) using 0.5 per cent of the households in the rural areas and 2 per cent in the urban areas. National Sample Survey Second Round (NSS2) was conducted between 1968 and 1971 and it covered 82.2 per cent of the rural areas and 37 per cent of the urban areas (95 towns) using a 1 per cent sample of households both in the rural and urban areas. The 1981 demographic survey was exclusively rural and used 46,703 households from 477 peasant association areas in 12 regions of the country (C.S.O., 1984a).

These surveys were not complete in coverage. NSS1 excluded Bale and Eritrea regions while NSS2 excluded Eritrea. The 1981 rural demographic survey excluded Eritrea and Tigray regions. Moreover, none of these surveys covered the nomadic population even in those regions which were included in the surveys. In addition to the problems of coverage, these data contained substantial errors of reporting and omissions. As a result there were no appropriate data that could enable the study of fertility or mortality trends. Nevertheless, very limited national and sub-national general fertility studies based on these data were done by the C.S.O. and others (Berhanu, 1985a; Ketema, 1985; Sileshi, 1985; Mengistu, 1989).

The C.S.O. has been providing basic indicators of fertility levels such as estimates of the crude birth rates, the child-woman ratios, the general fertility rates, the mean number of children ever born per woman as well as the total fertility rates in the form of statistical reports.

However, these estimates have very limited utility in describing the reproductive behaviour of Ethiopian women. The crude birth rate does not relate the births to women of child-bearing ages as it includes all ages and both sexes in its denominator. The general fertility rates although it controls for sex and restricts the births to women in the childbearing range, it does not control for the variation in childbearing within the reproductive age range. The child-woman ratios are often influenced by infant and child mortality, by errors of enumeration and by the age classification of children as well as by the effect of migration on population structures which may be important especially in rural-urban studies. The estimates of children ever born and total fertility rates are less reliable as these estimates were affected by errors of reporting and omissions.

In addition to these limitations, the reports present data in the form of statistical tables with limited analysis and explanations. For instance, in a study of the population situation in Ethiopia (C.S.O.,1988a), it was reported that the level of fertility has been high in the country and that recent trends indicate rising fertility in both urban and rural areas. It was also reported that there were regional variations in fertility in the country. However, the study failed to explain the causes for the apparently high fertility, the factors for the recent rise or the correlates of fertility differentials in the country. In addition, although the C.S.O. reports provide tabulations of fertility estimates by residence and region, they do not provide these estimates by religion, ethnicity or any other socio-economic variable, thus making the detailed examination of fertility differentials difficult.

Berhanu (1985a) explored the fertility and mortality patterns in the country by using the Brass and stable population techniques applied to the NSS2 data. He obtained estimates of TFR of 5.75 for the rural population and 4.6 and 5.5 for Addis Ababa and Asmara respectively for 1970. He argues that the moderately low estimated levels of Ethiopian fertility compared to other African countries may in part be due to errors of reporting and omissions and in part to marriage instability and within-marriage regulation by prolonged breastfeeding and post-partum abstinence. However, as the effect of marriage instability may be compensated by remarriages that follow shortly after a marriage dissolution and the average duration of post-partum abstinence does not exceed two months in most parts of the country, it is doubtful that these factors alone contributed to this low estimated level of fertility in the population. In addition to omission of children ever born and reference period errors regarding births in the last twelve months, other factors such as primary and secondary sterility, spontaneous abortions due to morbidity from malaria and other illnesses, and lack of exposure due to temporary separation of spouses might have played a substantially greater role in depressing fertility in those days.

Ketema (1985) applied a macro-level multivariate analysis on the data from the National Sample Survey Second Round to examine the extent of the effect of modernization on differential fertility. She used child-woman ratio as the dependent variable and a number of socio-economic variables (proportion of females 20-24 literate, proportion of females 20-24 in the labour force, proportion of females 20-24 married, proportion of males 20-24 literate, and two dummy variables, religion taking a value 1 if the area is predominantly christian, 0 otherwise, and residence taking 1 if urban and 0 otherwise) as independent variables. Her results show a significant urban-rural fertility differential but no religious differential. She also shows that while literacy had a weak direct relationship, female participation in the labour force had a weak inverse relationship to fertility.

However, as the study was carried out at a high level of aggregation, the results might have been affected by problems of aggregation bias. Since relationship between demographic variables and cultural and socio-economic variables vary from area to area, macro-level analysis rarely take into consideration cultural region specific factors. For instance Mammo (1988) in his study of mortality in rural Ethiopia show that for the same ethnic or religious group infant and child mortality varies significantly from region to region. This may apply to macro-level fertility studies as well. Statistical problems such as multicollinearity which tend to be substantial in macro-level analysis could also affect the results because in the presence of such problems the effect of closely related independent variables cannot be separated. Moreover, the use of child-woman ratio as a measure of fertility could also affect the results. The lack of religious fertility differential may partly be due to these problems. Mammo and Morgan (1986) have used the 1981 data and by way of examining childlessness provided estimates of marital fertility for the twelve regions of rural Ethiopia for which they had data and they argue that the sharp provincial variations in marital fertility are largely due to striking differences in infertility. However, except for the very old (those who have completed their childbearing), infertility appears to be low in the country and the variation in marital fertility may not be due to differences in infertility alone. Variations in other determinants such as duration and intensity of breastfeeding, infant and child mortality, and marriage disruption among others might have caused the differentials.

Two regional studies have also been done using the 1981 rural survey data. Sileshi (1985) in a study of fertility and child mortality in Arsi region attempted to examine levels and socio-economic differentials while Mengistu (1989) estimated fertility levels for Gondar in the north west and Hararge in the south east.

These various studies do provide some indication of the level of fertility in the country and also some of the socio-economic factors for the regional variations. However, they fail to provide a complete picture of the reproductive behaviour of Ethiopian women. As most of the fertility estimates were made using the indirect estimation techniques which are based on several assumptions, the validity of the fertility estimates depends on the correctness of the underlining assumptions. Further, the data were affected by various errors (omission of children ever born, reference period, age misreporting, etc.) which could lead to biased estimates. Moreover, the studies on differential fertility have very limited scope as the effect of demographic variables (age at first marriage, birth intervals, marriage disruptions and the like) were not included in these studies due to lack of data.

Apart from these studies, there has been no further detailed national or sub-national fertility studies in the country. This thesis attempts to fulfil two broad objectives:

The first objective is to provide reasonably accurate estimates of fertility levels and trends. Knowledge of the true levels and trends of the fertility of a population represents an important area of study not only in its own right but also in the contribution it may make to the broader field of explaining and predicting regional population dynamics and the testing of hypotheses concerning the general determinants of fertility. In addition, understanding of the levels and trends of fertility assists in predicting the onset and pace of fertility decline and in the design of intervention programmes for changing fertility behaviour and reducing population growth through lowered fertility. Ethiopia has been experiencing a major social, economic and political transformations since 1974. The nationalization and redistribution of rural and urban land and housing; the changes in the health policy from an elitist, curative and urban-based programme to a mass-based public health programme; the attempt made to improve the status of women, and the national literacy campaign are some of the changes that have taken place since the mid-1970s. With the nationalization of rural land, the use of hired private farm labour was banned and rural society was changed to one of relatively equal peasants. The nationalization of urban land and housing has led to a severe shortage of housing in the urban areas. The effort made in improving and expanding the health services has resulted in a moderate decline in mortality. Life expectancy has increased from 40 years in 1970 to 47.86 years in 1981 (Mammo, 1988). The relatively improved status of women through the formation of

Women's Association has increased their awareness and gave them equal right in the ownership of property. These changes are expected to have a substantial effect on the reproductive behaviour of women. By drawing on the experience of countries that had gone through similar social, economic and political changes, Mackay (1979) argues that fertility will rise and remain high for about 20 years or so as a result of these changes in Ethiopia. The survey on which this thesis is based was collected in 1986, about 12 years after the 1974 revolution - a sufficient time to assess the sort of changes in fertility mentioned by Mackay. The thesis examines how these changes operate on fertility both in rural and urban areas by providing estimates of the levels and trends and by giving explanations for the observed levels and trends of fertility.

The second objective of the thesis is to investigate fertility differentials by a range of socio-economic and demographic variables and to explain the reasons for the differentials.

Along with the study of levels and trends, examination of differentials appears to be a logical step in the fertility analysis of a population. The pattern of fertility differentials among population groups, such as rural-urban residence, and socio-economic groups is a question of principal interest in fertility research (UN, 1965). Knowledge of fertility differentials assists in the estimation of population growth rates for various segments of the population. Subgroups of a population with higher fertility contribute more to national growth than those with lower fertility when other things are assumed to be equal. It is useful to identify these groups of the population and obtain estimates of their fertility and isolate the factors that contribute to the differentials. These are crucially important in measuring the likely changes that are expected in a population in the future. Reliable and up-to-date information on fertility differentials also provide basis for future projections of changes on the overall level of fertility which may be expected as a result of changing social and economic conditions.

In Ethiopia, several ethnic groups following the two major religions, Christianity and Islam have been living next to each other for several hundreds of years without showing substantial socio-economic or cultural differentials. However, available data show a significant regional, religious and ethnic variation in the total fertility rates and in the average number of children ever born per woman in the country. Nevertheless, not much is known about the causes of these apparently wide variations. These differentials may well be explained by a variety of behaviourial factors ranging from different practices regarding the age at first marriage and remarriage of widows, differing levels of divorce and the period between divorce and remarriages, differing age for terminating reproduction or the cultural environment affecting the incidence of sterility and subfecundity.

In short, as the subject matter and methodology of this thesis are purely demographic, specific issues of the research are the factual consideration of the levels and trends of fertility and the examination of the relevant socio-economic and demographic factors that bring about fertility variation with reference to the population of Central Ethiopia.

Significant of the Study

(i) Ethiopia has existed as a national state for over two thousand years. In terms of population size, it stands next to Nigeria in Sub-Saharan Africa. However, little is known about its population characteristics. As stated earlier, studies about the demographic profile of the population are scarce. Not a single in-depth study indicating the levels and trends of fertility or mortality in the country as a whole is available. By providing estimates of the levels and trends of fertility and identifying the correlates of high fertility, this study attempts to narrow the gap in our present demographic knowledge about Ethiopia. (ii) The most outstanding features of the Ethiopian population are its high growth rates and extreme youthfulness. As the most recent estimates indicate, the rate of growth is about 3.0 per cent per year and the proportion under 15 is about 47 per cent (C.S.O., 1984a). The median age of the population is just over 17 years. While the crude birth rate is still high (about 47 per 1000), the crude death rate is gradually declining (from over 25 per 1000 to 18.4 per 1000 during the past decade). On the other hand, the growth of the national economy has been low mainly due to recurrent drought and civil wars. Under these circumstances, the country cannot tolerate the social, economic, political and environmental consequences of rapid population growth. This may call for a suitable population policy whose formulation and implementation requires a thorough understanding of the reproductive behaviour of the population. Hence another significance of the study is that it provides useful information on fertility levels, trends and differentials in the population which can be used by policy makers and planners. (iii) As this study is the first of its kind in the country to study fertility by using maternity history data, it is also significant in that it is hoped that it will initiate further in-depth and large scale research in this area in the country in the near future.

Data and Methods

As pointed out earlier, reliable data providing direct evidence of fertility levels (such as are yielded by comprehensive vital registration systems) are nonexistent. The materials from earlier surveys provide more or less indirect and fragmentary evidence of fertility levels and trends. Moreover, these materials are subject to grievous omissions and misreporting.

In the absence of a comprehensive vital registration system, insight into cohort trends in fertility can only be derived from special enquiries that collect maternity histories. Such a survey for the country as a whole has never been conducted. These problems limit this research from considering the entire population of the country. Consequently, the research focuses on the two regions, Arsi and Shoa (also spelt shewa) (see Figure 1.1), that form the Central Planning Zone of Ethiopia for which reasonably acceptable data for the study of fertility levels and trends are available at the individual or family level from the Population, Health and Nutrition Project baseline survey conducted by the Ministry of Health (M.O.H.) of Ethiopia in collaboration with the Centre for Population Studies of the London School of Hygiene and Tropical Medicine (University of London) between February and April 1986 (see Chapter 3 for details). The M.O.H. survey provides the first opportunity to study in more detail the reproductive behaviour of the various subgroups of the population and also makes possible the identification of the main socio-economic and demographic correlates of fertility in the two regions. In addition to this survey data, occasional reference is made to the National Sample Survey Second Round and the 1981 Rural Demographic Survey data regarding the two regions Arsi and Shoa.

The analysis begins by examining the quality of the data using internal consistency checks and comparison with independent sources. Because the dates of events (date of respondent's birth, date of marriage and the dates of birth of children) were missing, partially reported or were inconsistent for a significant number of the women in the sample, an imputation method (DEIR - a standard program for editing, imputing and recoding dates) developed for use in the WFS is applied to impute these dates (see chapter IV).

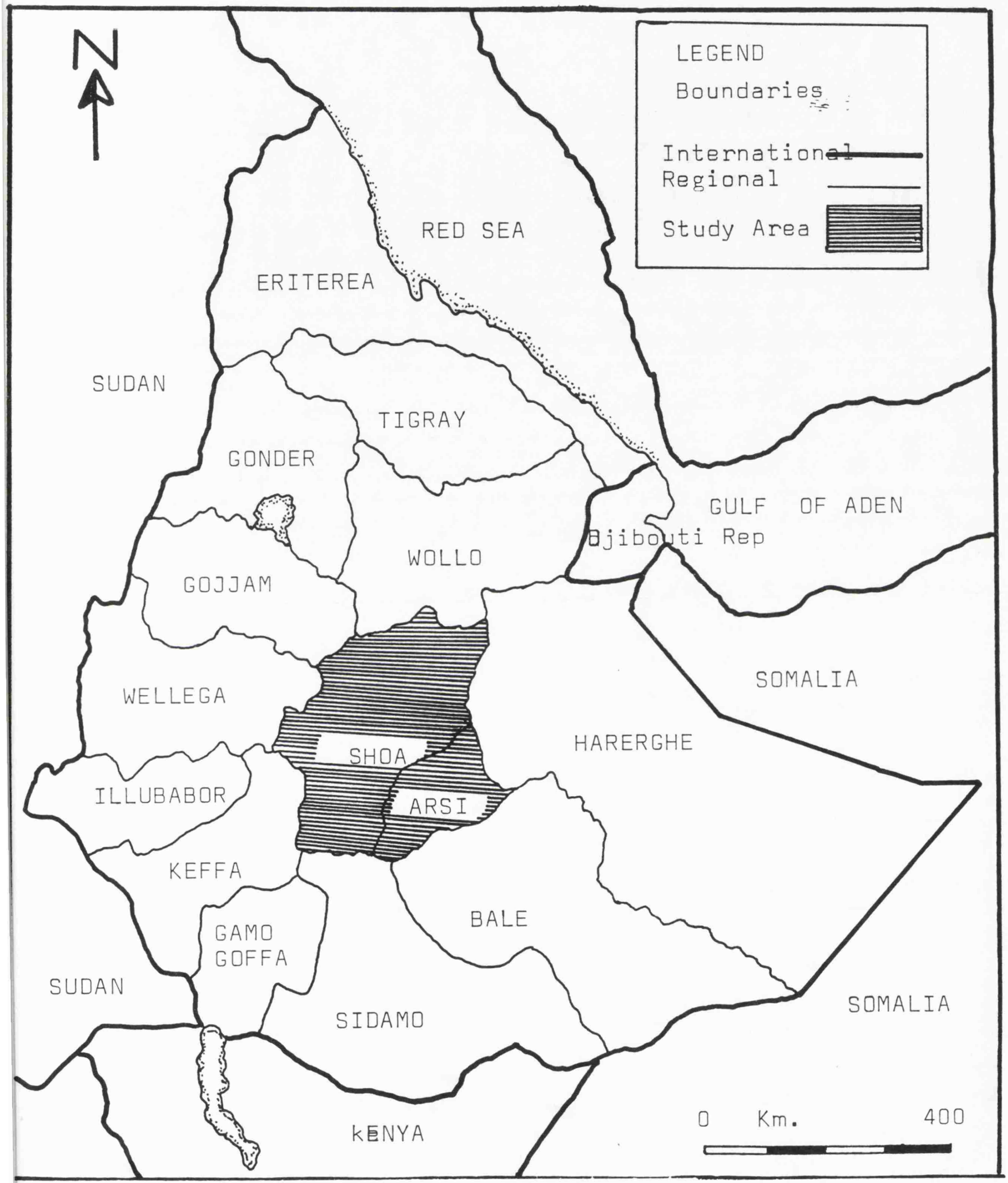
The analysis of fertility levels and trends is carried out using various demographic and statistical packages and fertility differentials are examined by applying multiple classification analysis (MCA), a technique for determining the interrelationship between a number of explanatory variables and a dependent variable within the context of an additive model.

Data analysis was done on the Amdhal, a main-frame of the University of London Computer centre. Several packages such as SIR, SPSS-X and WFS softwares were used in the analysis of the data. The Harvard Graphics package was used in the preparation of most of the figures presented in the thesis.

Organization of the Thesis

Including this introductory chapter, the thesis is structured in seven chapters. Chapter Two provides background demographic information about Ethiopia. It is intended to highlight the demographic profile of the country. It starts by discussing population growth, composition and distribution, and marriage patterns. It also provides estimates of fertility and mortality using the National Sample Survey Second Round and the 1981 Rural Demographic Survey. Chapter Three is on the data quality. It reviews the problems associated with poor quality data and provides a thorough examination of the data used in the thesis, and identifies the types and sources of errors in the data and suggests ways of collecting better quality data in future surveys. Chapter Four reviews the problems of non-response in surveys and the methods of handling them. It then considers the imputation of missing, incomplete or inconsistent dates of events by DEIR. The consistency and plausibility of the imputed data are examined and compared with the raw data and the quality of the data ascertained for fertility studies. Chapter Five investigates the levels and trends of fertility; it shows that fertility has remained high and has been rising in the recent past. The chapter also seeks explanation for the high level and rising trend. Chapter Six takes the issue of fertility differentials in the region. By applying a multiple classification analysis, it attempts to explain the differentials in fertility among the population subgroups. It would have been of interest to examine the proximate determinants of fertility but the available data do not allow this. Although questions were asked on the duration of breastfeeding, abstinence and amenorrhoea (no question was asked on induced abortion) for the last and pen-ultimate child, the relevant information was not obtained for over 75 per cent of the respondents. Information was collected on current status, that is, on women currently breastfeeding, abstaining, etc., from which duration can be obtained using the relationship: duration equals prevalence divided by incidence. However, this is not incorporated in the models because of the micro-level analysis adopted in the thesis. Consequently we examine differentials using the demographic variables of age at marriage, marital disruption, approval of family planning, together with the socio-economic variables of region, residence, literacy, religion and ethnicity. Children ever born are used as dependent variables. The final chapter summarises the main findings of the thesis and concludes by suggesting ways of narrowing the differentials and reducing the high fertility of the population.

Figure 1.1: **ADMINISTRATIVE REGIONS OF ETHIOPIA.**



Note: In 1989, both the number and boundaries of the administrative regions were changed. However, this change did not affect the boundaries of Arsi and Shoa (i.e., no part was removed or added to these two administrative regions).

CHAPTER II

PROFILE OF ETHIOPIAN DEMOGRAPHY

2.1. Introduction

Ethiopia is the seventh largest country in Africa with an estimated area of 1.23 million square kilometres. In terms of population size, it ranks second only to Nigeria in Tropical Africa with a projected population of 47 million in 1988 (C.S.O., 1985b).

Over 90 ethnic groups live in the country (Mammo, 1988). The exact proportion of each ethnic group in the total population is not yet known. However, it is believed that the Oromo ethnic group forms the largest proportion and the Amhara form the second largest. Other ethnic groups - Tigray, Gurage, Welaita, Kambatana Hadiya also comprise a significant proportion of the total population.

These various ethnic groups practice the two major religions, Christianity (Ethiopian Orthodox Christianity) and Islam. Like the ethnic composition, the religious composition of the population is also not exactly known. In addition to these two major religions, there are practitioners of the traditional African faith in the low land areas of Ethiopia bordering the Sudan and Kenya.

The economy is predominantly subsistence agriculture. Apart from being the single most contributor to GDP, agriculture provides some 80 per cent of exports and engages 85 per cent of the work force (Europa, 1989).

As a result of the long historical isolation of the country and the excessive conservatism of the church, literacy remained low. However, due to the nationwide literacy campaign which has been in operation since 1979, the literacy rate is reported to have increased from under 10 per cent at that time to over 60 per cent in 1984 (Central Planning Supreme Council (CPSC), 1984). Also as a result of the socio-economic change that has been taking place since mid 1974, the proportion of school age children attending primary school is reported to have increased from about 16 per cent in 1970 to 47 per cent in 1984 (World Bank, 1987b).

Health services are limited, covering less than half of the population. Moreover, they are biased towards urban areas. (For instance, four major urban centres, Addis Ababa, Asmara, Dire Dawa and Harar had 40 per cent of the physicians, 65 per cent of the health officers and over a quarter of the pharmacists, nurses and technicians in 1984 (M.O.H., 1986).) Consequently, communicable diseases mainly due to poor personal and environmental sanitation, lack of safe drinking water and adequate sanitation are the major health problems in the country.

In general, although the government promised accelerated modernization through reconstruction of the society, as the country fell victim to recurrent famine and chronic internal rebellion, hopes for rapid economic development collapsed and Ethiopia remains the least developed in the world with an estimated per capita income of only US $120.

As indicated above, Ethiopia is diverse in its ethnic and religious composition. Its cultural, religious and ethnic diversity along with its poor health conditions provide a great potential for demographic research. However, for various reasons, it has remained largely hidden to the demographic community. This chapter attempts to put together the available fragmentary data in order to draw the demographic picture of the country. It is hoped that this background information will be useful in the detailed examination of fertility trends and differentials in Central Ethiopia in later chapters. The chapter presents a brief discussion of population growth and distribution, age and sex structure, marriage pattern and mortality and fertility using data from the various surveys conducted by the Central Statistical Office.

2.2. Population Growth and Distribution

2.2.1. Population Growth

Absence of accurate time series of population data limits the estimation of the growth rate of the population over time. Although figures on the size of the population started appearing as early as mid-nineteenth century, they were based on guesses made by travellers and visitors. Moreover, these figures did not include the most densely populated southern and south western regions. Consequently, until the mid 1950s, no population data existed for the whole country.

The first effort made by the government to find out the size of its population was made by the Ministry of Interior in 1956. The Ministry conducted a head count of the population in order to determine the number of constituencies and representatives as well as the population of voting age for the first parliamentary election to be held in 1957. The head count covered 87 per cent of the total population and for the areas not covered, independent estimates were made. A figure of 19,500,000 was obtained for the country in 1956 (C.S.O., 1984a). In 1960, the Planning Board of Ethiopia relying on the Ministry's head count and other sources worked out the estimates and projections presented in Table 2.1 for various years from 1950 to 1966.

Table 2.1: Population of Ethiopia and its Rate of Growth.

year	population	rate of growth
1950	17,800,000	1.5
1954	18,900,000	1.5
1956	19,500,000	1.5
1957	19,800,000	1.5
1961	21,000,000	1.5
1966	22,600,000	1.6

Source: Ethiopian Observer No. 5. (1962).

Since the Ministry of Interior head count was purely for administrative purposes, there is fear that the estimates of total population were under-estimates and should be treated with the utmost caution.

It was Wolde Mariam (1962) who made the first reasonable estimate of the population of the country. Using the registered voters by region and some data available for urban centres, he estimated the population of Ethiopia to be 23,190,964 in 1957 and 24,581,027 in 1962 (Wolde Mariam, 1962). His estimate for 1957 was higher by over 3 million than the Planning Board's estimate for that year.

The C.S.O. (1984a), using the various surveys it had conducted since the mid-1960s, estimated the population as 22,803,000 in 1967; 24,068,000 in 1970; 31,904,100 in 1981 and the 1984 census resulted in a figure of 42,184,954 which was larger than the 1981 estimate by over 10 million.

Taken at face value, these figures indicate that the population was growing at 1.8 per cent per year between 1967 and 1970, at 2.6 per cent per year between 1970 and 1981 and at 8.2 per cent per year between 1981 and the census date. The rates for the period before 1981 seem plausible for a population with high fertility. However, the rate between 1981 and 1984 is clearly incorrect. In a population where international migration is negligible, such a rate of growth cannot be accepted. In fact, this suggests that past population figures seriously under-estimated the population of Ethiopia.

In order to have a relatively better picture of past population, the Central Statistical Office of Ethiopia reconstructed the population from 1984 to 1900 based on the census results by assuming various rates of growth. These reconstructed figures and the corresponding rates of growth with some estimates made by the UN are presented in Table 2.2 below.

If these figures are correct, it took about 60 years for the population to double and reach 25 million from its 1900 value of 11.75 million. The natural rate of population growth has increased from 1.8 per cent per year in the 1950s to 2.9 per cent in 1984. At this rate of growth, the population will double in about 24 years and reach 84 million before year 2010. The World Bank (1987a) estimates the assumed date at which NRR will equal 1 as year 2040, the population momentum as 1.9 and the hypothetical size of the stationary population as 204 million. This indicates that Ethiopia's population is one of the fastest growing populations in Africa and will continue to grow fast unless effective policy measures are taken in time.

Table 2.2: Population Estimates 1900-1984

	population (000,000s)		growth rates (% p.a.)	
year	UN	C.S.O.	C.S.O	UN
1900		11.75		
1910		12.12	0.4	
1920		12.93	0.8	
1930		14.37	1.1	
1940		16.28	1.3	
1950	17.67	19.18	1.75	1.8
1960	20.70	23.50	2.09	2.1
1970	25.05	29.49	2.36	2.3
1980	31.09	37.69	2.51	2.6
1984	42.19	42.19	2.60	2.8
1985	43.34	43.34	2.80	2.9

Source: U.N. (1970, 1975, 1980). Demographic year books.
C.S.O. (1988b).

2.2.2 Population Distribution

Urbanization

Urbanization in Ethiopia is at its infancy. Until about the early 1940s less than 3 per cent of the population lived in urban areas (Mulat and Abate,1988). This figure has increased to 8.5 in 1967, to 9.7 in 1970 and to 10.4 in 1984.

Although a significant change, it is only average in comparison with other African countries. Comparative figures for other African countries in the region show that the percentage of the urban population has increased from 12 per cent to 20 per cent in Kenya and from 27 to 34 per cent in Somalia between 1960 and 1984 (World Bank, 1987a). The rate of growth of the urban population was 4.75 per cent from 1967 to 1984 while the corresponding rates were 9.0 for Kenya, 5.1 for Sudan and 6.1 for Somalia (World Bank,1987a).

Table 2.3 : Per cent Distribution of Urban Population, Level of Urbanization, Growth Rate of Localities and Population.

	number of		% of Urban		level		growth rate	
	localities		population		(%)		localit.	popul.
region	1967	1984	1967	1984	1967	1984	1967	1984
Arsi	7	20	2.09	2.69	5.3	7.1	6.1	6.2
Bale	3	9	0.83	1.58	8.9	6.9	6.3	8.4
Eritrea	17	12	13.77	9.19	15.6	14.8	-2.0	2.4
Gamo G.	6	9	1.25	1.44	3.8	5.0	2.3	5.6
Gojam	9	30	3.39	5.34	4.2	7.2	7.0	7.4
Gondar	9	20	3.54	4.50	5.7	6.8	4.7	6.1
Hararge	14	33	8.03	6.82	5.1	7.2	5.0	3.8
Illub.	5	11	1.10	1.16	3.4	5.3	4.6	5.1
Keffa	5	14	2.66	2.77	4.4	4.9	5.9	5.0
Shoa	33	80	45.23	47.73	18.8	21.9	5.1	5.1
Sidamo	15	31	4.69	5.23	4.0	6.0	4.2	5.4
Tigray	14	18	5.63	4.29	6.6	7.8	1.5	3.2
Wellega	8	17	2.09	2.41	3.5	4.4	4.4	5.6
Wollo	12	21	5.69	4.84	5.0	5.8	3.2	3.8
Total	157	325	100.00	100.0	8.5	10.4	4.3	4.8

source: M. Rafiq and A. Hailemariam (1987).

The number of localities with 2,000 or more inhabitants has nearly doubled between 1967 and 1984. It increased from 165 to 325, an increase of about 4.0 per cent per year. There has been faster upward mobility of towns with less than 20,000 inhabitants from one size class to the other during the period (see Rafiq and Hailemariam).

Examination of the level and pattern of urbanization by region shows that the relative contribution made by the various regions to the overall urban population varied substantially. Shoa and Eritrea were the most urbanized regions accounting for 56.9 per cent of total urban population in 1984, while Bale, Gamo Gofa and Illubabor put together accounted for only 4.2 per cent. Shoa alone accounted for over 47 per cent of total urban population. This is because Shoa includes Addis Ababa, the capital, which contained about 30 per cent of the total urban population in 1984, and the existence of several urban localities with large populations owing to the proximity of Addis Ababa, the capital. The rate of growth of the urban population also shows massive variation ranging from 8.4 per cent per year in Bale to 2.4 per cent in Eritrea between 1967 and 1984. (see Table 2.3 above).

Of the fourteen regions presented in Table 2.3, ten had growth rates larger than the national average while four had lower rates. Bale, Gojam, Arsi and Gondar had rates of growth between 8.4 and 6.1 per cent. The low rates observed for the two most northern regions, Eritrea and Tigray may be due to the higher out-migration due to the continuous civil war and the more severe drought in these regions.

In general, urbanization in Ethiopia is characterized by a concentration of small size settlements and dominance of one large city. Rafiq and Hailemariam (1987) show that about 57 per cent of the localities fell in the size class of 2,000-

4,999 and over 80 per cent had less than 10,000 inhabitants while only 4 per cent of the localities contained 50,000 or more inhabitants in 1984. It appears that the structure of urbanization will continue without any marked change for some time to come. The prevailing severe shortage of housing coupled with sluggish economic development in urban areas may inhibit rural- urban migration and thus curb the growth in the number of localities as well as the size of urban population at least for some time into the future.

Migration

In pre-1974 Ethiopia, both temporary and permanent internal migration were common. Few data are available to estimate the rate of internal migration and its trend over time. However, it may be suggested that due, partly, to the feudal type of land holding system and partly to low productivity of agriculture and the expansion of mechanized farms in the mid 1960s and early 1970s, a large number of peasants migrated to the urban centres or to the cotton and sugar plantations on the Awash valley and the Rift Valley lakes looking for jobs. Temporary migration of peasants from the non-coffee growing northern regions to the coffee growing southern and south western regions during the coffee picking season was also common. Berhanu (1985b), for instance, mentions: seasonal movement of coffee-pickers (more than 50,000) to coffee districts from other parts of Keffa and Wollo regions; more than 15,000 highlanders annually to collect incense in Tigray region; and tens of thousands of farm labour migrants to irrigation schemes in low land areas such as Setit Humera in Northwestern Ethiopia and the Awash River valley in Central and Northeastern Ethiopia. Kloos (1982) from a study of a sample of the Awash farm population (about 150,000) finds that more than one third consisted of seasonal migrants. The high growth rates observed in most urban centres in the 1970s was also mainly due to rural-urban migration. Hailu (1982) showed that in 1970 over 50 per cent of the population in the urban centres were migrants, of whom more than 60 per cent had rural origin. He also shows that in most of the fast-growing towns, rural- urban migration accounted for more than 50 per cent of the growth of the population. Mesfin (1982) also concludes that internal migration has played an important role in the urbanization process in shaping the spatial configuration of urban agglomerations and consequently providing population concentration in the country. In post-1974 Ethiopia however, the magnitude of migration has been reduced as temporary rural to urban migration as well as migration to other areas has been substantially limited mainly due to the land reform programme. From questions on place of birth, it was discovered that only 5.6 per cent of the rural sedentary population were born outside the awraja (province), of which half were born outside the administrative region, while over 78 per cent reported that they were born in the same place and 16 per cent reported that they were born outside their place of current residence, but within the awraja (province) in 1981 (C.S.O. 1981 Rural Demographic Survey). This indicates that rural to rural migration is not of a significant magnitude in Ethiopia.

Recently, there has been a sizeable out-migration of refugees from Eritrea, Tigray and Hararge regions (see Figure 1.1), mainly to the border countries of Sudan and Somalia, owing to war and recurrent drought and famine. This has been estimated to be around a million people. The World Bank (1985) states that this out-migration reduced the natural rate of growth of the population from 2.5 per cent to a little over 2.0 per cent during the early 1980s. Since many of these migrants stay at their place of destination for only a short time and return when conditions become favourable to their place of origin, it is doubtful that this will have a long--term effect on the growth of the population. For instance, a substantial number of refugees had returned from Djibouti and Somalia after the end of the Ethiopia-Somalia war in 1977.

2.3. Age-Sex and Marital Structures

2.3.1. Age-sex Structure

Table 2.4 presents the age structure for the male, female and total population in 1967, 1970 and 1984. Although the sets of data from which the age structures have been computed might have been distorted to some extent by errors arising from age mis-statement and errors of enumeration, they clearly show the main characteristics of the Ethiopian population, the most outstanding of which is the extreme youthfulness of the population.

Table 2.4: Age Structure of the Population.

year	male			female			total		
	< 15	15-64	65+	< 15	15-64	65+	<15	15-64	65
1967	45.9	51.1	3.0	41.4	55.7	2.9	44.6	52.4	3.0
1981	45.9	50.2	3.9	44.9	51.9	3.2	45.5	51.0	3.5
1984	47.0	48.3	4.7	46.0	50.3	3.7	46.5	49.2	4.3

source: for 1967 and 1980: Computed from UN, Demographic Year Book (1970, 1980);for 1984: from C.S.O. (1985c).

The table shows that the proportion under 15 years of age has shown some increase during the period. It has increased from 44.6 per cent in 1967 to 46.5 per cent in 1984. The proportion between 15 and 65 years of age has been falling since 1967, while the proportion of the aged has shown a moderate increase. The age structure of the population by sex shows that the proportion of the female population under 15 years of age increased from 41.4 per cent to 46.0 per cent and that for males, it increased from 45.9 per cent to 47.0 per cent over the period. The proportion of the aged (65 years and over) increased from 3.0 per cent to 4.7 per cent for males and from 2.9 per cent to 3.7 per cent for females. Those in the economically active age range (15-64) have fallen for both sexes. However, as the data are unreliable, it is difficult to establish whether the age structure has truly changed by such a magnitude.

In general, it is safe to say that the Ethiopian population is becoming younger and younger. The median age, which was 18.0 in 1967 has declined to 17.5 in 1984 (UN., 1986). The dependency burden has been increasing. The crude dependency ratio increased from 91 persons for every 100 persons of working age in 1967 to 103 persons for every 100 persons of working age in 1984. On the whole, the age pattern of the population is similar to that of many developing countries with high fertility and moderately declining mortality. The high proportion of the population under 15 years of age indicates a higher potential for future growth.

Sex Structure

Before 1984, the population had a slight excess of males. According to the C.S.O (1984a), the reported sex ratio for the total population was 103 males per 100 females in 1967 and in 1981. However, the 1984 figure shows that the number of males equalled the number of females giving an overall sex ratio of 100. This slight shift in the sex structure in 1984 from a population characterized by slightly higher males than females to one with about the same number of males and females may be due to: (i) heavy male mortality resulting from wars (Ethiopian Somalia War of 1977/78 and the civil war in Northern Ethiopia), (ii) substantial male out migration from the country in the war and drought affected regions, and (iii) higher male under enumeration in the 1984 census. (The census coincided with the launching of the national military service and as a result, there may be an under-enumeration of young males.)

The rural and urban sex structure shows a different pattern. The sex ratio for the rural population was higher than the urban sex ratio, indicating the masculine character of the rural population. In 1967 and 1981, the sex ratio for the rural population was 104. It then declined to 102 in 1984. On the other hand, for the urban population, the sex ratios were extremely low. The ratio was 85 males to every 100 females in 1978 and 1981. In 1984, it was 86 males per 100 females for all urban centres excluding Addis Ababa. For Addis Ababa, the ratio declined from 105 in 1965 to 90 in 1978 and in 1984 it further declined to 86 males per 100 females.

The sex ratios for the urban population are much lower than the ratios observed in the urban populations of many African countries. This is mainly because of the female dominated rural-urban migration in Ethiopia. Unlike the pattern in many African countries, there have been higher rates of rural urban migration of females aged 15 to 49 years in Ethiopia (C.S.O.,1984a). The reason is that widowed or divorced rural women usually prefer to migrate to the urban areas to work as maidservants or bartenders.

2.3.2. Marital Structure

Forms of Marriage

Three forms of marriage, namely, religious marriages, civil contract marriages and customary marriages are recognized by the civil code in Ethiopia. Religious marriages are practised by people with high religious affiliation and they are in principle indissoluble except with special dispensations. Civil contract marriages are practised by the urban elites while customary marriages are practised by the majority of the urban and rural populations. Marriage contracts are signed in a church or mosque in the case of religious marriages and in a municipality in case of civil contract marriages. In case of customary marriages, however, the marriage contract is written and publicized before the village official and blessed by a religious leader of the community.

Although the civil code has never allowed polygyny, a small proportion of polygynous marriages exist particularly among the wealthier members of the muslim population in the remote rural areas. The C.S.O. (1974), from its second round national sample survey estimated the proportion of ever-married males 10 years and over with more than one wife as 10 per cent. They also show that the proportion increased with age and reached 15 per cent for those 55 years and older (C.S.O., 1974). Data on polygyny were not collected in the 1981 survey. However, Lesthaeghe et al (1986) suggest a method of computing a polygyny ratio using data on current marital status cross-tabulated by age and sex of the population aged 15 years and over obtained from surveys or censuses. Using their approach, the estimated polygyny ratio was 5.1 per cent for the rural population of Ethiopia in 1981. This indicates that the proportion of polygynous marriages have been low and declining probably due to unfavourable socio-economic situation since 1974.

Proportion Ever Married.

Like many traditional societies, marriage in Ethiopia has two major features - universality and early marriage. Data on the proportion ever-married by age is a good indicator of the universality of marriage. Table 2.5 below presents the proportion of ever married women for the rural, urban and total populations in 1970, and for the rural population only in 1981.

The table shows that among women aged 45-49 years, less than one per cent remained single in both the urban and rural populations in 1970. The proportion has not changed much in 1981 for the rural population.

The table also shows that the proportion of women ever married rises with advancing age for both rural and urban populations. The proportion ever married for the rural population started at 10.2 per cent for women in the 10-14 age group, reaches 63.8 per cent for those in the 15-19 age group and for those in the 25-29 age group, it reached 99 per cent. For the urban population, however, the proportion starts at a value slightly lower than 50 per cent for those in the age group 15-19, increased to over 92 per cent in the 20-24 and reached 99.7 in the 45-49 age group. For both the rural and urban populations, over 90 per cent of the women are married by age 25 and more than 97 per cent are married by age 30 in 1970.

Table 2.5: Proportion of Ever Married Women (1970 and 1981)

	1970			1981
age group	rural	urban	total	rural
10-14	10.2	-	-	8.6
15-19	63.8	47.1	62.2	55.4
20-24	94.5	92.2	94.3	93.3
25-29	99.0	97.7	99.1	98.6
30-34	99.2	98.8	99.3	99.2
35-39	99.6	99.4	99.7	99.4
40-44	99.8	99.6	99.8	99.6
45-49	99.9	99.7	99.9	99.6

Source: for 1970: C.S.O, 1974;
for 1981 C.S.O, 1980/81 Rural Demographic Survey.

This trend has not changed much since then. Data for the country as a whole or for the urban areas is not available in the 1980s as the census results have not yet been published. However, as Table 2.5 shows, except for some fall in the 15-19 age group, the pattern remained more or less the same in the rural areas. This slight fall in the proportion ever-married in this age group may be due to higher proportion of young females postponing marriage and going to school in 1981 than in 1970.

Age at Marriage

Another feature of marriage in Ethiopia is the age at which it starts. Marriage in Ethiopia takes place at an early age for both sexes though a little higher for males. In most cases males marry before age 25 and females before they are 17 years old. In some rural areas marriage may begin before age 10 for either partner, in matches arranged by parents. However, married children do not start living together as husband and wife until the girl's menarche.

In the absence of data on age at first marriage, a simple way of measuring the mean age at first marriage is Hajnal's Singulate Mean Age at First Marriage (SMAM), which measures the average number of years spent in the single state among women ultimately marrying (Hajnal, 1953). The singulate mean age for the rural population was 22.9 for males and 16.9 for females in 1970 and in 1981 the figures were 23.2 for males and 17.1 for females. It appears that there has not been much change in the age at marriage for both sexes. In the urban areas, however, the SMAM values are relatively higher for both sexes. It was 25.1 years for males and 18.1 years for females. There were differences in SMAM's of 2.1 years and 1.2 years respectively in the rural and urban areas.

A note worthy point is the difference in the SMAM values between the sexes. In 1970, the difference between the male and female SMAMs was about 6 years in the rural areas and 7 years in the urban areas. This shows that there was on average 6-7 years difference between the marriage ages of husbands and wives in 1970. In 1981, for the rural population, the figure was 6.1 years which implies that there has not been any change in the age gap between husband and wife.

Apart from slight rural-urban differentials in the SMAM values, there appears to exist some regional differentials. The 1981 C.S.O. survey data show that female SMAMs range from 15.5 in Gojam region to 19.2 in Wellega region. In the North-Western regions of Gondar and Gojam, females marry much younger compared to other regions. In Hararge, Shoa and Sidamo, the SMAMs were about 18 years while for most of the remaining regions, they cluster around 16 and 17 years.

Marital Dissolution

In Ethiopia, marital dissolution appears to be common. As Table 2.6 shows, among the population aged 10 years and over, 5.3 per cent of the females in the rural areas and 23.4 per cent in the urban areas excluding Addis Ababa were divorced in 1970. The proportions widowed were 11.2 per cent in the rural and 7.7 per cent in the urban areas in 1970, while the corresponding figures were 10.0 per cent and 11.2 per cent in 1978.

The table also shows that the proportion of widowed and divorced females exceeds the corresponding figures for males in both rural and urban areas. It also shows higher proportions divorced in the urban areas than in the rural areas, while the proportion widowed was lower in urban than in rural areas for both sexes except for 1970 where the proportion of widowed females was slightly higher in the urban than in the rural areas.

The substantially higher proportion of divorced females in the urban areas may be due to their tendency to remain unmarried. Geil and Lujik (1968) from their study of a road-side town in south-western Ethiopia show that divorced females more often prefer to remain unmarried than divorced males. This may be because urban women are economically less dependent on males than their rural counterparts.

The distribution of the female population by marital status and age presented in Table 2.7 shows that marriage dissolution starts early in Ethiopia. Of the ever married women aged 10-14 years of age in rural Ethiopia, 2.0 per cent were either widowed or divorced in 1970. The figure for 1981 was 2.7 per cent. This may not be due to real rise but due to data errors (e.g., age shifting).

The proportion widowed steadily increased with age in both periods. However, in 1981, higher proportions of females in the younger ages (10-14 to 25-29) were widowed than in 1970. This slightly higher proportion of widowhood in 1981 may in part be due to higher young male deaths resulting from the Ethiopia-Somalia War and internal political problems during the late 1970s. The proportion divorced is higher in 1970 than in 1981. If the first two age groups (10-14 and 15-19) are excluded, the proportion divorced forms a sort of 'U' shaped curve in both periods.

Table 2.6: Marriage Dissolution by Rural and Urban Residence: 1970 and 1978.

	1970				1978			
	divorced (%)		widowed (%)		divorced (%)		widowed (%)	
	M	F	M	F	M	F	M	F
rural	3.2	5.3	2.2	11.2	3.0	5.0	2.0	10.0
urban	4.9	23.4	1.3	7.7	6.2	22.6	1.8	11.2

source: C.S.O. (1984a). Study of levels, trends patterns and Differentials of Fertility and Child Mortality.

Though hard facts are unavailable, it appears that the leading factors for marriage breakdown besides mortality are desertion, infertility and illness of spouse. In north western regions, where the age at marriage is very low, young females usually abandon their husbands and prefer to migrate to the urban areas. In some other places, men who migrate to the urban centres for temporary jobs decide to settle permanently and want their wives to accompany them. Often parents of their spouses do not support this idea and that means the end of the marriage.

In some instances, a marriage may breakdown because a woman may fail to produce a child. Since the primary objective of marriage in Ethiopia is the begetting of children, an infertile marriage usually ends in divorce. A persistent illness of either spouse may also lead to marriage breakdown.

Table 2.7: Marital Status Distribution by Age Group: Rural Ethiopia (1970 and 1981).

	1970				1981			
	percentage				percentage			
age grp.	sing	mar.	widow.	divor.	singl	marr.	wid.	div.
10-14	89.9	8.2	0.2	1.8	91.4	5.9	0.4	2.3
15-19	32.7	60.8	0.5	6.0	44.6	49.1	1.3	5.0
20-24	3.6	89.9	1.0	5.3	6.7	87.0	1.8	4.5
25-29	1.0	93.4	1.6	4.0	1.4	93.1	2.2	3.3
30-34	0.7	91.0	3.7	4.5	0.8	93.4	2.9	2.9
35-39	0.4	89.4	5.8	4.1	0.4	92.3	4.2	3.0
40-44	0.4	79.8	13.9	5.8	0.7	85.9	8.5	4.8
45-49	0.4	72.2	21.4	5.7	0.4	80.3	12.9	6.5

source: for 1970 C.S.O. (1974)
For 1981 C.S.O. computed from the 1980/81 Rural Demographic Survey data tape.

2.4. Mortality and Fertility

2.4.1. Mortality

Though many developing countries have recorded substantial declines in mortality rates and gains in life expectancy at birth over the last thirty years or so, there are still many countries with very high mortality rates and low life expectancies. Most of these countries are found in Africa and Ethiopia is one of them.

Due to lack of reliable time series data, the actual level and trend of mortality in the country is not well documented. However, the Central Statistical Office, by using the two rounds of national sample surveys, the 1981 rural demographic survey and the 1978 manpower and housing survey of seventeen major towns attempted to estimate the crude death rate, infant mortality rate and the expectation of life at birth at various years since 1970. Table 2.8 presents the reported crude death rates and infant mortality rates obtained from these surveys for the rural and urban areas while Table 2.9 presents the rates adjusted using Brass's children ever born and children surviving procedure with their corresponding life expectancy at birth.

Table 2.8: Crude Death Rates and Infant Mortality Rates.

	rural areas			urban areas	
	1967	1970	1981	1968	1978
crude death rate	22.0	12.3	14.7	6.4	11.1
Infant mortality	83.7	90.0	113.0	56.0	109.0

source C.S.O. (1984a).

The reported crude death rates and infant mortality rates are very low by Ethiopian standards. The Central Statistical Office attributes these low values to variation in sample coverage, methodology and gross under-reporting of deaths (C.S.O., 1984a). Since these figures were computed from information on deaths in the household during the last twelve months, it is likely that the under-reporting was mainly due to the short reference period in addition to the under-reporting of dead children, in particular, infants who had died shortly after birth.

Table 2.9: Adjusted Crude Death Rates, Infant Mortality Rates and Life Expectation at Birth (1970-1981).

	rural areas			urban areas		
	1970	1981	% change	1970	1978	% change
CDR	19.3	17.7	-8.3	17.6	16.2	-8.0
IMR	151.0	144.0	-4.6	141.0	129.0	-8.5
e_0	44.9	46.6	3.8	42.2	48.5	15.0

source : C.S.O. (1984a) table 5.2a p.75 and 5.2b p.76.

The adjusted estimates for 1970 are in agreement with estimates made by Berhanu (1985a). He obtained an infant mortality rate of 155 per 1,000 live births, a crude death rate of 19.8 and a female life expectancy at birth of 45.2 years from data of the national sample survey second round (1967-71). The estimates of life expectancy obtained by both the C.S.O. (1984a) as well as Berhanu (1985a) appear a little inflated when compared with that obtained by Mammo (1988). His estimate of life expectancy was about 40 years in 1970. Nevertheless, these estimates indicate high level of mortality in the population. For instance, bout 15 per cent of children died before their first birthday in 1970 and in 1981, a little over 14 per cent died before their first birthday in the rural areas. The mortality level indicators do not differ much between rural and urban areas in spite of the concentration of health services in the urban centres. Infant mortality and crude death rates differed by 10 and 2 points per 1000 respectively between rural and urban areas in 1978. Life expectancy appears to be higher in the rural areas by about 2.7 years in 1970. This may however be due to the higher under-reporting of deaths in the rural areas and should be treated with caution.

In general, it appears that both urban and rural areas experienced moderate declines in mortality between 1970 and 1981. Urban areas experienced greater declines in infant mortality than rural areas. Infant mortality declined by over 8.5 per cent in the urban areas while in the rural areas it declined by about 4.6 per cent. However, the data on which these mortality estimates were based suffer from various errors (age misreporting, omission of deaths, etc.). For instance, comparison of Table 2.8 and 2.9 show that the adjusted estimates of CDR and IMR were over one and half times higher than the reported values in 1970 and in 1981, these values were over one and a quarter times higher than the reported values. This indicates that the reported mortality indicators were extremely poor and that the results derived from them should be treated with care.

Age-sex Pattern of Mortality

Although the reported age-sex specific death rates are low and distorted by errors of age misreporting and omission of deaths, they present the age-sex pattern of mortality in the country (see Table 2.10 below).

The rates start at very high values for infants, decrease with advancing age and attain their minimum at about age 10-14 before they start increasing. This is true for both males and females. When the proportion of total deaths by age and sex is considered, deaths to children under 5 years of age account for about half of total deaths and deaths to children under 1 account for 25 per cent of total deaths. Deaths to children between 5-9 years of age range between 5 to 9 per cent of total deaths while for those aged 10-14, the death rates are the lowest, ranging between 3 and 4 per cent of total deaths (see Table 2.11).

Table 2.10: Reported Age-sex Specific Death Rates.

Age Group	1970 male	1970 female	1981 male	1981 female
under 1	88.0	91.0	90.4	74.3
1-4	22.0	17.0	18.9	19.1
under 5	34.0	31.0	33.3	30.5
5-9	6.0	5.0	5.6	5.8
10-14	4.0	4.0	3.4	2.8
15-49	4.2	6.4	4.6	6.0
50 and over	17.6	20.9	18.1	19.2

source C.S.O. (1984a) Table 5.5 p.85.

Table 2.11: Proportion of Total Deaths by Age Group and Sex.

age group	1970 male	1970 female	1981 male	1981 female
under 1	25.7	26.4	28.1	24.2
1-4	29.0	23.4	23.3	23.9
under 5	54.7	49.8	51.4	48.1
5-9	10.3	7.2	8.7	9.0
10-14	3.8	2.9	3.7	2.7
15-49	15.5	25.6	15.4	21.8
50 and over	15.7	14.4	20.8	18.4

source C.S.O. (1984a) table 5.6 p.87.

About 36 per cent of total male deaths and about 40 per cent of female deaths occur to the population aged 15 years and over. For the population aged between 15 and 49 years, the proportion of female deaths is higher than that for male deaths. About one fifth of all female deaths occur to women of child bearing ages while the corresponding proportion for the males was about 15 per cent. The heavier female mortality in the reproductive ages is mainly due to maternal mortality which was estimated to be around 20 per 1,000 live births (Teka and Nichola, 1984). Female mortality appears to be slightly heavier even after their reproductive ages as Table 2.11 shows. This slightly higher observed female mortality compared to males may not necessarily suggest that females have higher mortality but that male deaths have been under-reported. For instance, Mammo (1988) using the Brass Growth Balance Method estimated the completeness of death registration as 0.395 for males and 0.604 for females in 1970 and 0.491 and 0.593 respectively for males and females in 1981.

2.4.2. Fertility

Although data are not available, observers of the late 19th and early 20th century state that fertility in those days was low in Ethiopia (Ketema, 1985). Families of 5 or more children were rare. It may be difficult to attribute this mainly to low fertility in a population where infant and child mortality was very high. However, there is a consensus that high rates of childlessness resulting from pathological problems were common during those days. Merab (1902), observed that childlessness ranged from 15 per cent to 20 per cent at the turn of the century. He attributed this partly to early marriage and partly to venereal diseases.

As time passed and modern medicine was introduced into the country, this trend changed and the proportion childless declined substantially. Mammo and Morgan (1986) show that the proportion of childless women among those born in 1917 and before was about 12 per cent and among those born in the 1940s, it was just over 5 per cent. They also show that the proportion of women with no second birth (given a first birth) was 16 per cent among women born in 1917 and before and 6 per cent among those born in the 1940s. They conclude that this decline has resulted in moderate increase in fertility (Mammo and Morgan, 1986).

All the surveys conducted by the Central Statistical Office of Ethiopia had included questions on children ever born, children surviving and births during the last 12 months before the survey. The reported crude birth rates obtained from these surveys were 44.0 births per 1,000 in 1965, 38.2 per 1,000 in 1970 and 43.4 per 1,000 in 1981 (C.S.O., 1984a). The low values for 1970 should be treated with caution as this may be due to inaccuracy in the data. The Central Statistical Office adjusted the reported crude birth rate using stable population techniques and arrived at a value of 46.4 births per 1,000 in 1981. If we assume that the adjustment and the underlying assumptions are correct, this shows that the reported births were under-estimated for 1981 also, although the 1981 rural demographic survey data were supposed to be of high quality.

Estimates made by other sources are higher than the C.S.O. estimates. The United Nations and the World Bank estimates have been around 49 births per 1,000 population since 1975.

The crude birth rate, though important, has limited analytical utility as an indicator of the trend of fertility of a population as it does not take into account the age and sex structure of the population. The child-woman ratio, which is the ratio of children under 5 to women of reproductive ages is a relatively better measure. This ratio has been steadily increasing in Ethiopia since 1965. It was 769 per 1,000 women 15-49 years of age in 1965, 813 in 1970, and in 1981, it reached 898 per 1,000 (C.S.O.,1984a). It would be difficult to take this as due to increase in fertility alone as the ratio is seriously affected by infant and child mortality as well as by migration. This continuous rise in the child-woman ratio may be due to improving infant and child mortality, better reporting of children ever born, or a rise in the fertility performance of the population - or a combination of all or some of these.

A more refined indicator of the trend of fertility is the number of children ever born per woman at a specific age. In a non-literate society, however, distortions arising from errors of omission of children who have died at infancy and those who have grown up and/or married and left the household may affect the mean number of children of older women. Due to memory lapse, older women usually fail to report the number of children they have born correctly (Brass et al, 1968). After examining data on children ever born and children dead at two different times (1970 and 1981), Mammo (1988) suggests some omission of children by older women. By assuming that the errors of omission of children ever born are the same for both 1970 and 1981, we can examine the reported mean parities in the country.

As Table 2.12 shows the mean parities reach their peak at age group 45-49 as expected for both years in the rural areas. For the urban areas including Addis Ababa, however, the number of children ever born declines at older ages. This may partly be due to under-reporting and partly to past lower fertility arising probably from infertility. If we ignore the mean parities of women 15-19 years of age as this age group is affected by the smaller number giving birth and also by errors of age shifting, we see that the mean parities for women in the age group 20-24, 25-29 and 30-34 who are expected to have accurate reports of the number of births they have had, indicates an increase between 1970 and 1981 for both the rural and urban populations.

The mean number of children ever born by women who have completed their child bearing span has also increased from about 5.3 to 5.7 in the rural areas, from 3.7 to 4.7 for other urban areas and from 3.5 to 4.4 for Addis Ababa. If our assumption of the same magnitude of error of omission of children is valid, we may conclude that fertility has been rising in Ethiopia. However, it is unlikely that the errors of omission would remain the same since better techniques of data collection, use of better trained enumerators and improving literacy would reduce the error of omission of children ever born. Thus the observed increase in the mean number of children ever born may partly be due to improved data collection and better reporting. Nevertheless, when the reported values were adjusted for errors of omission using Brass's P/F ratio method, the adjusted values also indicate a rising trend. The adjusted mean number of children were 7.04 and 7.96 in 1970 and 1981 respectively for the rural populations and 3.97 and 5.8 for Addis Ababa in 1967 and 1978 while for other urban areas it was 3.9 in 1970 and 6.3 in 1978 (C.S.O., 1984a).

Examination of the age specific fertility rates also indicates an upward trend between 1970 and 1981 for both the urban as well as the rural populations except for Addis Ababa. The rates show a substantial increase for each age group of women except the 15-19 age group (see Table 2.13). This age group has shown some decline of about 23 per cent in the rural areas and in the urban areas it was almost a constant. The decline in the rural areas may be due to a slight upward trend in the age at first marriage. The total fertility rate computed from the reported age specific fertility rates was 5.10 in 1970 and 6.82 in 1981 for the rural population. TFR and CEB were nearly the same in 1970 but in 1981, TFR was about 20 per cent higher than CEB. In the absence of reporting errors, this suggests a substantial increase in fertility. But errors of reference period as well as omission of births might have contributed to some of this.

Table 2.12: Mean Number of Children Ever Born.

age	rural areas		Addis Ababa		other urban areas	
group	1970	1981	1967	1978	1970	1978
15-19	0.447	0.620	0.302	0.161	0.250	0.315
20-24	1.653	1.790	1.334	1.140	1.200	1.737
25-29	2.919	3.200	2.441	2.646	2.326	3.020
30-34	3.804	4.340	3.310	3.841	3.077	4.088
35-39	4.721	5.270	3.900	4.703	3.757	4.852
40-44	4.975	5.620	3.615	4.644	3.711	4.971
45-49	5.285	5.740	3.567	4.377	3.709	4.688

Source: C.S.O (1984a);1981 Rural Demographic Survey.

For the urban areas other than Addis Ababa, there was also some increase in the total fertility rate. It increased from 3.14 in 1970 to 4.36 in 1978, an increase of about 40 per cent. For Addis Ababa, however, there was a decline of about 4.0 per cent.

A further examination of the age specific fertility rates indicates a slight shift in the age pattern of childbearing between 1970 and 1981. In 1970 over 60 per cent of the total fertility was accounted for by women under 30 years of age in both rural and urban areas. In 1981, however, this had declined to 50 per cent in the rural areas. The urban areas including Addis Ababa also show some decline, though not significant. The mean of the age specific fertility schedule has also increased moderately. According to the C.S.O. (1984a), the mean of the age specific fertility schedule has increased from 28.5 years to about 30.1 years in the rural areas and from 28.4 to 29.5 years in the urban areas excluding Addis Ababa. For Addis Ababa, the mean increased from 29.1 to 30.3

years during the period. However, these values are suspect due to errors of age reporting and reference period.

Table 2.13: Reported Age Specific Fertility Rates.

age group	rural areas 1970	rural areas 1981	Addis Ababa 1967	Addis Ababa 1978	other urban areas 1970	other urban areas 1978
15-19	0.145	0.133	0.060	0.044	0.064	0.065
20-24	0.255	0.272	0.193	0.176	0.170	0.218
25-29	0.234	0.298	0.213	0.195	0.150	0.222
30-34	0.167	0.251	0.171	0.148	0.128	0.148
35-39	0.133	0.227	0.110	0.105	0.074	0.118
40-44	0.057	0.123	0.034	0.048	0.025	0.074
45-49	0.039	0.060	0.015	0.046	0.017	0.026
Total	5.15	6.82	3.98	3.81	3.14	4.36

source: C.S.O. (1984a) and the 1981 rural demographic survey data tape.

Fertility was moderate in the past due to factors such as the high incidence of primary and secondary sterility but as modern medicine became available, childlessness declined and fertility started increasing. However, as data quality also improved over time, part of the increase may be attributed to improvement in data collection and better reporting by women. In the later parts of the thesis, we will examine in detail the levels and trends of fertility in central Ethiopia by analysing the Ministry of Health's maternity history data and provide explanations for this increase in fertility.

2.5. Summary and Conclusion

From the foregoing general description of the socio-economic and demographic features of Ethiopia, we see that the country is one of the least developed in the world with a subsistence agriculture base. About 40 per cent of its population do not read and write, and over 50 per cent do not have access to medical services. The proportion of total population getting clean drinking water is about 6 per cent. Malnutrition is prevalent affecting about 40 per cent of the population (Wolde Mariam, 1984). Most of the infant and child mortality is caused by diarrhoea, respiratory infections and the six major preventable diseases of childhood (measles, poliomyelitis, tuberculosis, diphtheria, whooping cough and tetanus).

Fertility, which was moderate in 1970 appears to have increased to a high level in 1981 in the rural areas. Noticeable increase in fertility also appears to have occurred in the Urban areas between 1970 and 1978 perhaps partly due to better data collection. Although the death rate is falling, it is still around 20 per 1,000 persons. Further decline is evident in the face of expanding health services. The population growth rate has accelerated from a little over 2.0 percent per year in the 1950s to about 3.0 per cent per year in the 1980s. The total population which was estimated to be 21.2 million in 1955 had doubled in about thirty years and exceeded 42 million in 1984. At the current rate of growth, it is expected that the population will double in less than 25 years and reach 84 million.

It was pointed out earlier (see Chapter One) that fertility is the major contributor to a rapid growth in a population and it is important to investigate its levels, trends and socio-economic and demographic correlates. However, as we have pointed out earlier, adequate data are not available for the whole country, and this thesis examines the levels, trends and differentials of fertility in Central Ethiopia only. But first we shall examine the quality of the data on which we base our studies and make some adjustments.

CHAPTER III

SOURCE AND QUALITY OF DATA

3.1 Data Source

A survey was conducted by the ministry of Health of the Government of Ethiopia in collaboration with the London School of Hygiene and Tropical Medicine between February and April 1986 in the two regions of Arsi and Shoa in Central Ethiopia which have a little less than a quarter of the total population of the country. (The Central Statistical Office of Ethiopia, (C.S.O.), using the 1984 Census projected the population of the country as 44.65 million of which 10.32 million lived in Arsi and Shoa in 1986.) The Survey was financed by the World Bank and it was a part of a much wider Population, Health and Nutrition Project whose objective was the reduction of infant and maternal mortality and the improvement of access to family planning services among the populations of these regions (Blacker, 1986). The primary objectives of the survey were: (i) to identify priority needs in the fields of maternal and child health and family planning, and (ii) to provide bench-mark indicators which will help the measurement of future progress (Blacker, 1986).

On the basis of these objectives, the survey collected information on the demographic, health and socio-economic characteristics of the population by utilizing two questionnaires - a household and an individual questionnaire.

Since the survey was more detailed than the surveys conducted in the past, because it collected birth history data for the first time in the country, and since such data are appropriate for studying fertility levels and trends in the absence of vital registration systems, or regular surveys or censuses, this study is mainly based on the data tape of this survey. In addition the 1981 Rural Demographic Survey data are also used in order to provide further information for this study.

3.1.1. Survey Design and Sample Size

A two stage stratified sampling design was used in the selection of the samples in each of the two regions with the strata consisting of urban and rural areas. In the rural stratum, Farmers Associations constituted the primary sampling unit while in the urban areas, the Kebele (Urban Dwellers) Associations constituted the primary sampling unit. No mapping or listing of households was involved because the Central Statistical Office provided the sampling frame.

In the first stage, a total of 100 Farmers Associations (85 from Shoa and 15 from Arsi) and 50 Kebeles (43 from Shoa and 7 from Arsi) were selected systematically with probability proportional to the number of households enumerated in the 1984 census from the list of Farmers Associations and Kebeles provided by the Central Statistical Office.

In the second stage, from each of the primary sampling units, a constant number of households (25 from each Farmers Association and 20 from each Kebele) were selected systematically by the team supervisor from the list of households provided to him by the Farmers' Association or Kebele official and these constituted the secondary sampling unit. Whenever a selected household could not be identified or an eligible woman was not available for interview, the selected household was substituted by another. Assuming an average of one eligible woman per household, a total of 2,500 households in the rural area and 1,000 in the urban areas were selected giving an overall sample of 3,500 households. (See Blacker, 1986 for details).

3.1.2. The Questionnaire

The Ministry Of Health (M.O.H.) survey questionnaire was comparable to the WFS survey design in that it used two devices - a household schedule and an individual questionnaire. The household schedule although primarily intended to identify women of reproductive age eligible for the individual interview, also recorded background demographic and socio-economic characteristics of the members of the household. It collected information on: the type of the dwelling unit; source of drinking water; presence in the household of economic goods; and for each member of the household, sex, age, relationship to head of household, ethnicity, religion and survival of parents. The individual questionnaire was applied to all women of reproductive age and gathered the woman's background information, her birth history, health status of her children under five, knowledge and ever use of family planning methods and fertility preferences. It had seven sections. In section one, data on age, date of birth, literacy, current and childhood place of residence and nuptiality were recorded, while section two was entirely devoted to birth history data. In section three, information on vaccination and immunization as well as morbidity of children under five was collected. Section four secured information on spacing variables - breastfeeding, amenorrhoea, and abstinence for the last and penultimate child (though with little success as the required information was gathered for a very small number of women). Current pregnancy information was obtained in section five, while in section six data on knowledge and ever use of both traditional and modern methods of birth control were obtained. Section seven collected information on fertility preferences - achieved and desired number of children, and approval of any method of preventing pregnancy (see Appendix I).

In general, the content of the questionnaire was organized in line with the survey objectives and most of the questions were pre-coded. However, it had some limitations worth noting. Both the household schedule and the individual questionnaire omitted some questions which if included would have been very useful in the study of fertility. For instance, the household schedule failed to collect information on the literacy and marital status of household members. Also it failed to collect information on the births and deaths in the household during the preceding 12 months before the survey. The individual questionnaire did not contain a section on the woman's work experience, her husband's education and occupation, and her pregnancy wastage - abortions and still births. Apart from these omissions, the data on the dates of birth of children were limited to month and year only. In a population where literacy is low and birth certificates are not available, women frequently fail to report the exact month and year of the birth of their children. This has resulted in a significant number of births with missing date of birth and/or inconsistent birth intervals as we shall show later in this chapter. If a question on age of the child at the time of the survey or the season of birth of the child were included, the proportion of missing dates, or inconsistent birth intervals would have been reduced. Another problem with the questionnaire was that the marriage history was limited only to two categories - married once and married more than once and no information was collected on the date of, or the reason for, the end of the previous marriage and the date of the beginning of the next one. Although it was not clearly stated as to how the problem of more than one eligible woman in a household was solved, it appears that only one eligible woman who was the wife of the head, or the head herself in case of single, widowed and divorced women was selected. However, this may not lead to a substantial bias in the estimates of fertility as the proportion of women aged 15-49 who were not included in the individual questionnaire (including visitors) was found to be less than 4 per cent when the numbers from the individual questionnaires were compared with those from the household questionnaire.

3.1.3. Field Work Procedures

A total of thirty enumerators were recruited and trained and they were deployed into the field in teams of one male and one female interviewer. The male interviewer completed the household schedule and part of the individual questionnaire. The other part of the individual questionnaire, which contained the most private and sensitive questions relating to topics such as amenorrhoea, abstinence, etc., was completed by the female interviewer. One supervisor was assigned for every five teams. The entire field operation lasted for about two and a half months. A total of 3,490 household and 3,431 individual questionnaires were completed from an expected total of 3,500.

3.1.4. File Processing

Computer-based survey processing involves four major steps. First, the data are coded and entered on to media such as diskettes or magnetic tapes. Second, the machine readable data are validated by checking for out of range codes, inconsistent values, total number of cases, etc. and correction made. Third, the corrected data are prepared for analysis. This involves the extension of the base file to include derived variables, modified version of original variables, combining codes of categorical variables, and the conversion of non-rectangular or hierarchical files to rectangular format (i.e., converting to a standard format of complete data matrix with a fixed number of records per case). Finally, the data are analysed.

In our case, the code sheets were prepared by the Ministry of Health of Ethiopia and the data were entered on to diskettes (later transferred on to magnetic tape) by the London School of Hygiene and Tropical Medicine using SIR/DBMS. Our further data processing procedures consist of (i) checking and correcting errors and inconsistencies, (ii) Preparation of the analysis files and (iii) the analysis itself.

As noted earlier, the data file was created using SIR/DBMS and it contained five record types. Household socio-economic and demographic variables constituted records one and two respectively. Records three, four and five were formed from the individual questionnaire. Sections one, five and six of the questionnaire formed record three while section two - the birth history section - formed record four. Record five was formed from sections three, four and seven (see Appendix I).

SIR is an efficient package for data storage, because it stores the data in a hierarchical structure using minimum storage space. Moreover, it has two-stage data editing (range and consistency checks) and good tabulation facilities (see SIR User Manual). However, it has some limitations which hinder its extended use in data processing. First, it is expensive for handling large survey data files because it requires substantial amounts of machine time and memory during retrieval execution. Second, the current version of SIR does not allow this entire data file to be edited at the same time because of program size limitations and space. Third, SIR jobs are usually vulnerable to machine or software failure, because they can take hours of elapsed time and since SIR does not have restart facilities, the job has to be restarted from the beginning causing delay in the processing of the data (Ellis, 1987). Finally, SIR has very limited facilities for statistical analysis and hypothesis testing and most of the available statistical packages do not handle data in hierarchical structure. These limitations in SIR called for file interface with some other package. Consequently, the SIR data file was interfaced with SPSS (as the current version of SIR cannot be interfaced with SPSS-X). Variables were retrieved, modified, new variables computed and arranged, and a temporary SPSS save file was created which was read later by SPSS-X; a permanent file was created and most of the data analysis was done using SPSS-X.

3.2 The Quality of the Data

The M.O.H. Survey provided relatively detailed information for the study of fertility levels, trends, differentials and other related factors. However, the usefulness of the study depends on the quality of the data, since errors and biases can easily affect the reliability and accuracy of the estimates derived from it. The experience of the WFS and similar surveys has indicated that data obtained from retrospective fertility surveys are subject to various kinds of errors.

In this section, we attempt to evaluate the quality of the information reported in order to determine the accuracy of the data and search for any apparent errors or inconsistencies in response. We also aim to throw light on the extent to which these errors bias fertility estimates and on the shortcomings of the data collection procedure which may be rectified in future surveys.

Data mainly from the individual questionnaire are examined using internal consistency checks and whenever possible, comparison is made with the 1981 Rural Demographic Survey data.

3.2.1 Age Reporting and the Age Distribution

The importance of accurate age data in demographic analysis and socio-economic planning is well known. The computation of basic measures of population change (fertility, mortality and migration) requires an accurate age distribution of the population. The analysis of factors affecting the supply of labour force, the study of problems of economic dependency, and health and educational planning are some of the areas where accurate age data are crucially important. However, in many countries, particularly in the developing world, age data obtained from censuses and surveys are usually defective and studies based on the reported age distributions have revealed massive errors (Blacker, 1971).

Distortions in age distributions may arise from age selective omission, age misreporting or both. Cultural and religious values may prohibit the reporting of certain age groups. For instance, in some cultures in Africa, children may not be reported due to the fear that they will die.

Age misreporting may be caused by the data collection procedure, the respondent or the enumerator. Defective data collection procedures, in particular, the wording of the question on age could cause errors in the age data. Asking how old a person was at last birthday in cultures where people are ignorant about birthday and do not celebrate it, may lead to incorrect age reports. The respondent, due to ignorance may fail to report his age or the ages of others about whom questions are asked. This is true especially when one member of a household supplies the majority of the information about other members of the household (Ewbank, 1981). It is also possible that respondents deliberately falsify their ages in order to avoid taxation or military conscription or they may report ages ending in preferred digits and avoid others. This latter type of error leads to peaks in ages ending in the preferred digits and troughs in those that were avoided.

Interviewers also introduce age errors by either failing to probe the reported age, or by making guesses based on physical appearance, marital status, or the number of children ever born to the respondent. Female ages are more likely to be influenced by interviewers than male ages. Gibril, (1975) from the analysis of the Gambian census age structure, concluded that women over age 20 had their ages exaggerated due to the exclusive reliance of the interviewers on a woman's parity as a basis for estimating her age.

Apart from errors of omission or age misreporting, age distributions may be influenced by factors that are inherent to the society. Migration, past high mortality resulting from epidemics, wars, famines, or high fertility in the past could lead to irregularities in the age structure of the population. It is important, therefore, to examine the age structure of a population in its historical context in order to identify the causes of the distortions if any.

In this section, we first examine the age structure of the de facto population enumerated in the household schedule in order to identify age errors by computing various indices for measuring the accuracy of age reporting. We also compare the age distribution of the population with the 1981 rural demographic survey age distribution. This we hope will assist to : (i) evaluate the quality of the age data, (ii) identify the type of errors in the data, and (iii) establish the pattern of age errors in the study area over time. We then examine the age data from the individual questionnaire.

Age Reporting in the Household Schedule.

Figures 3.1(a) and 3.1(b) present the percentage distribution in single years of the rural male and female de facto population enumerated in the household schedule together with the corresponding distribution obtained from the 1981 Rural Demographic Survey. Instead of a fairly smooth distribution with slightly lower proportions of the total population at each successive single year of age, the figures show a saw edged pattern indicating age heaping. Considerable heaping of ages in multiples of 5 and to a lesser extent in multiples of 2 is observed. Ages ending in 1, 9 and 3 show sizeable troughs indicating the avoidance of these digits. The heaping is more acute for women between the ages of 20 and 60 years. It appears that the M.O.H. data show slightly less heaping than the 1981 C.S.O. data although the pattern remained essentially the same.

The preference or avoidance of ages ending in certain digits in a single year age distribution can be measured using several indices. A common index is Whipple's index which measures heaping on digits 0 and 5. It is computed by assuming that the true figures decrease by equal numbers from age to age over the age range and computing the ratio of the population ending in digits zero and five over the range 23 to 62 to one fifth of the total population in the range and multiplying the result by 100 (Shryock et al, 1976). It avoids the ages of childhood and extreme old ages, because these are more affected by other types of errors than by age heaping; also the assumption of equal decrement from age to age is less applicable due to heavier mortality in these ages. The value of the index ranges between a minimum of 100 representing no concentration and a maximum of 500 when no digit other than zero and five are recorded.

Whipple's index was 237 and 281 for males and females respectively in 1981 while in 1986, it was 226 for males and 216 for females. Three things may be observed from these values. First, the indices are high for both surveys indicating substantial heaping on ages ending in 0 and 5. Second, the index was higher for females in 1981 while in 1986, it was reversed with a slightly lower value for females than for males (this may be because of collecting both age and date of birth for the females in the M.O.H. survey), and third, the M.O.H. age data appears to be slightly less affected by heaping compared to the C.S.O. age data.

A major drawback of Whipple's index, however, is that it measures heaping on two digits only, namely zero and five. Also it fails to indicate the preference or avoidance of other digits. A more refined measure of digit preference is Meyers' 'blended index' which takes into account all digits from zero through nine. The method derives a blended population which is essentially a weighted sum of the number of persons reporting ages ending in 0, 1, 2, 3, ..., 9. The underlying assumption is that in the absence of any systematic irregularities in the reporting of age, the blended sum at each terminal digit should be equal to 10 per cent of the total blended population. An excess of 10 per cent at any terminal digit indicates an over selection of ages ending in that digit and a deficit indicates under selection. An overall measure of the extent to which there is a digit preference or avoidance is the index of preference, which is obtained as half of the sum of the absolute deviations for each terminal digit from 10 per cent (UN, 1967). Like Whipple's index, Meyers' index also avoids the ages of early childhood for similar reasons.

Meyers' index dis-aggregated by place of residence and sex further confirm the extensive heaping at digits 0 and 5 for both sexes in rural and urban populations (see Table 3.1). Zero is the most preferred digit followed by 5 and 8 in that order while 1 and 9 are the most avoided ones. The summary indices show that heaping is greater for males than for females and greater in the rural areas than in the urban areas.

Table 3.1 : Meyers' Index of Digit Preference.

	Deviation from 10 per cent					
preferred	total		urban		rural	
digit	male	female	male	female	male	female
0	12.5	10.1	8.9	6.7	12.8	8.6
1	-6.4	-5.9	-5.9	-5.5	-6.8	-6.2
2	-3.6	-0.7	-0.4	0.0	-4.0	0.5
3	-3.0	-1.8	-2.9	-2.4	-3.5	-2.0
4	-3.2	-2.6	-1.4	-1.9	-3.7	-3.5
5	8.8	8.7	3.8	6.5	8.8	8.5
6	-1.1	1.7	-3.1	-0.2	-0.7	-2.2
7	-2.0	-3.2	-1.3	-1.6	-2.7	-4.1
8	2.9	1.2	3.1	2.9	2.2	6.4
9	-5.0	-5.5	-4.3	-4.6	-5.5	-6.1
Total	24.3	20.7	17.5	16.2	24.5	24.1

Figures 3.2(a) and 3.2(b) illustrate the indices for the M.O.H. survey and the 1981 survey. Similar patterns are observed in both surveys although the indices for females from the M.O.H. survey show a substantial improvement.

Five Year Age Distribution

The preceding discussion revealed that the single year age distribution of the population is substantially distorted by errors of heaping. It is usually suggested that grouping the distribution reduces these errors.

Figures 3.3(a) and 3.3(b) display the percentage distribution of the population of Arsi and Shoa in 5-year age groups by sex for 1981 and 1986. Although grouping the data has ironed out most of the irregularities present in the single year age distribution, there are still peaks and troughs between age 20 and 40 and also a deficit of children under five years of age in the M.O.H. data. Furthermore, the population pyramids presented in Figures 3.5(a) and 3.5(b) exhibit many features of the data. Substantially larger number of females than males were observed at 20-24, 25-29 30-34 and 35-39 age groups and smaller numbers beyond age 40. Both the M.O.H. and the C.S.O. age structure show similar patterns. This is a feature prominent in the reported age distributions of many tropical African censuses and surveys (Ntozi, 1977). For instance, the 1963 census and the 1982 fertility survey of Nigeria (Morah, 1985) and the 1971 census and the 1979 fertility survey of Sudan (Rizgala 1985) had features similar to those present in this population. It is perhaps due to the over-estimation of the ages of teenage females upwards to the 20s and the under-estimation of the ages of older females in their 40s downwards into the late 30s. It may also be due to the exaggeration of the ages of males.

The deficit of children under 5 years of age may partly be due to age exaggeration of young children by interviewers or respondents and partly due to omission. As the individual questionnaire contains questions on the health status of children under 5, it is very likely that the interviewers shifted the ages of these children upwards so that they avoided collecting information on the health of children and thus reduced the burden of work.

The extremely low proportion of females between 15-19 and 45-49 years of age may in part be due to what is usually called the 'boundary effect' in fertility surveys (Goldman et al, 1985). As age 15 was the main determinant for eligibility for the individual questionnaire, interviewers might have deliberately shifted females aged between 15 and 19 years downwards to the under 15 group and those aged between 45 and 49 upwards into the 50-54 age group in order to avoid interviewing some females. The wide variation in the age and sex ratios computed for the five year age group bracketing the lower boundary and the upper boundary of the eligible age range further confirms that the age data is distorted by boundary effects (see Table 3.2 below).

In order to measure the extent of distortion resulting from boundary effect, we compute indices using the approaches of Goldman et al (1985). They define U and L as the indices of measuring the upper and lower boundary effects. They used the following formula:

$$U=[SR(i)-SR(o)]-[AR(i)-AR(o)]; \quad L=[AR(i)-AR(o)]-[SR(i)-AR(o)].$$

SR(i) is the sex ratio for the group just inside, SR(o) is the sex ratio for the group just outside. AR(i) and AR(o) are similarly defined for the age ratios. Positive values of U and L indicate a shift into the eligible age range while negative values a shift out.

Table 3.2 : Lower and Upper Boundary Effects.

Age	Age ratio (A.R)	sex ratio (S.R)
14	1.546	0.738
15	0.593	1.669
16	1.218	1.208
48	1.754	1.560
49	0.505	0.769
50	1.893	3.110

The values of L and U are respectively -79.0 and -141.4. These values are much larger than those obtained for some African countries in the region that participated in the WFS. For instance, for Kenya, L was -48 and U was -19 indicating exclusion of some eligible women from both ends of the eligible age range while for Sudan L was 10 and U -13 indicating inclusion of ineligible women from the lower age and exclusion of eligible women from the upper end of the eligible age range (Goldman, et al 1985).

The high and negative values of both the lower and upper boundary indices in our case is perhaps in part due to the exclusion of a large number of potentially eligible women from the eligible age range by the interviewers. Similar values were obtained for both the rural and urban strata indicating that in both cases some women were moved away.

Another way of detecting and measuring the overall extent of age misreporting is to examine the age and sex ratios and to compute an index of age accuracy (Shryock et al, 1976). Age and sex ratios were computed using the 1981 C.S.O. and the 1986 M.O.H. age-sex structures for the rural population. Figures 3.4(a) and 3.4(b) present the age ratios for males and females respectively while Figure 3.6 presents the sex ratios. Theoretically, and in the absence of any upheavals in the demographic process in the past, the population of a country or a region should have slight excess of males at the younger age groups, about equal number of males and females in the middle ages and an excess of females in the older ages and the age ratios should approximate 100 at each age group.

The inconsistent zigzag pattern of the age and sex ratios observed in Figures 3.4 and 3.6 confirms our previous observation about the nature of the data. The overall age-sex ratio index was 16.6 for males and 9.5 for females. This further confirms the greater misreporting of age for males than for females. The average of the two (13.1) is a measure of accuracy of the age data. Comparison with the age and sex ratios of the 1981 survey data shows no improvement in the M.O.H. household age data for males. However, for females, there was a substantial improvement except in the younger and older ages. The overall index declined from 13.6 to 9.5 for females, while for males, it retained its 1981 value which was 16.3.

The sex ratios presented in Table 3.3 are similar for the rural and urban populations. However, the urban ratios appear to be more distorted than the rural ratios for the age groups 10-14 through 30-34. This is perhaps due to a substantial migration of females to the urban areas and partly due to age errors. (We have pointed out in the previous chapter that in Ethiopia, unlike many countries in Sub-Saharan Africa, young widowed or divorced females migrate to the urban centres looking for jobs.) The sex ratios are very low for both the urban as well as rural populations especially in the age groups 20 through 40. This may be due to the Ethiopia-Somalia War of 1977/78 and also due to the ongoing civil war in Northern Ethiopia. When the rural sex ratios are compared with those of the 1981 C.S.O survey, a similar pattern emerges although the M.O.H. data appear to be slightly better (see Figure 3.6).

Table 3.3 : Sex Ratios of the Population :Arsi and Shoa.

Age group	Rural	Sex Ratio Urban	Total
0-4	1.070	0.884	1.018
5-9	0.948	1.037	0.971
10-14	1.011	0.857	0.959
15-19	1.640	0.896	1.318
20-24	0.827	0.633	0.767
25-29	0.696	0.327	0.572
30-34	0.768	0.599	0.714
35-39	0.823	0.863	0.834
40-44	1.097	1.570	1.203
45-49	1.181	1.247	1.197
50-54	1.057	1.065	1.059
55-59	1.115	0.712	1.009
60-64	1.270	0.646	1.058
65-69	1.776	0.870	1.461
70-74	1.415	0.630	1.920
75-79	3.214	0.420	1.210
80 +	1.500	0.890	1.360

In general terms, the age and sex distributions of the household population appear to have extreme variations which may bring into doubt the reasonableness of the estimates derived from such data. However, the data are not as bad as they appear because most of the variations and inconsistencies were due to sex selective rural-urban migration, wars, drought and famine among others rather than due to errors alone.

Age in the Individual Questionnaire.

In line with the WFS experience, the individual questionnaire was designed to include two questions relating to age of the respondent. An eligible woman was first asked how old she was at the time of the survey. She was then asked to report the month and year of her birth. About 99 per cent of the surveyed women reported their current age of which about 18 per cent reported the month and year of their birth, while 16 per cent reported the year of birth only. This shows that due to the absence of vital registration system, the low level of literacy and the low importance attached to one's date of birth in this society, a very small proportion of the surveyed women reported their date of birth. A further examination of the reported age and date of birth for those who reported both the current age and date of birth, indicates that a substantial proportion of women especially in the older age groups reported either their current age or date of birth incorrectly.

Age at survey is computed using the information on month and year of birth for those who reported these and for those who reported year of birth only, we assumed that the woman was born at the middle of the calendar year. (The calendar used in the survey was the Ethiopian Calendar which is 7 years and 8 months behind the Western Calendar. Conversion to the Western Calendar was done by adding 7 years and 8 months to the date of the event.) Then the difference between the reported age and the computed age is obtained. Ignoring differences of less than 0.5, It may be observed that 5 per cent of women under 30, 11 per cent of those between 30 and 40 years and 35 per cent of those over 40 years reported either the date of birth or the current age incorrectly. The lower proportion for the younger women may be due to higher literacy among these women.

Since the proportion of women who reported their date of birth (including those who reported the year of birth only) was only 34 per cent and since this is too small to make cross tabulations for further analysis of the data, the reported age distribution is examined for errors of reporting.

The reported single year age distribution from the individual questionnaire for eligible women is presented in Figure 3.7. The curve peaks at ages ending in 0 and 5 and to a lesser extent at 8 and 2, and there are corresponding troughs at ages ending in 9 and 1. The peaks are more pronounced at ages 30 and 35. When the data were compared with those of the household schedule for the same age range (15-49), the pattern of heaping is identical although the individual age distribution appears to be less affected.

The percentage distribution at each terminal digit of age for women aged between 15 and 44 from the individual and household schedules are presented in Table 3.4, together with corresponding figures for selected African countries. We have also computed Meyers' (not blended) and Whipple's indices. A glance at Table 3.4 shows that the distribution is similar to that of other African countries. However, the summary indices (both Meyers' and Whipple's) are larger than those for most of the countries - except Mauritania and Sudan. This suggest that the M.O.H. age data are poorer than most of those presented in the table.

It may also be observed from the table that the pattern of age heaping in both the household and individual data is roughly the same implying that the age data from the two sources are not entirely independent.

Table 3.4 : Percentage Distribution of Women at each Terminal Digit of Age and Meyers' and Whipple's Indices for Selected African Countries and the M.O.H. Data.

country	terminal digits											
	0	1	2	3	4	5	6	7	8	9	Mey.	Whi.
Cam.	21.0	7.3	9.5	9.1	8.2	12.4	8.6	5.8	12.2	5.9	31.2	167.0
Gha.	17.4	9.1	11.0	7.7	9.5	13.1	9.0	6.3	8.6	8.1	23.1	153.0
Ivc.	14.4	11.1	12.3	9.4	9.9	11.5	9.8	8.1	7.5	5.9	18.4	130.0
Ken.	15.7	8.7	9.6	7.8	8.4	15.0	7.5	9.1	10.5	7.8	22.3	154.0
Sud.	24.8	4.6	7.5	4.6	4.9	30.3	4.4	5.5	8.2	4.9	70.3	275.9
Maur.	22.7	7.6	6.3	5.6	9.8	19.0	6.2	5.2	5.2	8.6	47.9	198.0
MOHh.	19.4	3.4	9.8	6.0	4.3	18.3	9.2	8.7	14.1	5.3	45.1	188.5
MOHi.	18.0	6.1	9.9	6.8	4.2	17.2	9.9	9.1	13.1	5.5	36.8	176.0

For the M.O.H., MOHh indicates household data and MOHi indicates the individual data; Source: Goldman et al (1985).

When the single year age distribution is grouped into five year groups, the resulting distribution is similar to that obtained from the household data. There are substantial deficits at 20-24 and 30-34 and corresponding surpluses of females at 25-29 and 35-39. This may partly be due to heaping and age shifting and partly due to the resettlement of people from the densely populated areas in Shoa region to North Western and Western regions. As a result of the 1984/85 famine, people from the famine affected regions of Wollo and Tigray were resettled in North Western and Western regions. This has also affected people in the densely populated areas of Shoa region. Woldegiorgis (1989) reports that 108,241 peasants (men and women aged between 15-55 years) from Shoa region were resettled in Gojam, Wellega, Illubabor and Keffa regions of Western Ethiopia in 1985 alone. He also reports that at the initial stage volunteers were taken but later as the number of volunteers dwindled, people were rounded up from farms, streets and market places and loaded on to trucks and were taken away by force. This indicates that entire village members were not moved and those who could hide or ran away could escape. Therefore, it appears that the observed age structure might have been affected by the mobilization of people for resettlement in addition to the usual errors of heaping and age shifting.

3.2.2 Accuracy of Nuptiality Data

Nuptiality is concerned with the frequency, characteristics and dissolution of marriages (Wilson, 1985). Unlike other demographic events - mortality, fertility and migration, nuptiality does not directly affect the number of persons in a population. However, its close link with fertility makes it a very important demographic variable.

In great majority of societies, socially acceptable childbearing occurs within marriage. As a result, the overall level of fertility in a population is affected by the age at marriage, the proportion ever-married and the dissolution of marriages. Reliable and accurate information on age at first marriage, the proportion ultimately marrying and the dissolution of marriages is useful in the assessment of the effect of nuptiality on the levels, trends and differentials of fertility.

Errors in nuptiality data usually take the form of under coverage of women in marital unions, misreporting the date of start or end of marital unions, mis-statement of current marital status and the omission of marriages. Errors of age misreporting may also distort data on nuptiality. In this section we attempt to examine the quality of the nuptiality data as reported in the individual questionnaire.

The individual questionnaire first ascertained the current marital status of respondents and then collected information on the time of onset of first marriage. It also asked respondents whether they were married once or more than once. Unlike the WFS surveys, no information was collected on the marriage history of respondents.

Date and Age at First Marriage

A fairly large proportion of the ever-married women among the younger age groups reported the date of marriage. Among women under 30 years of age at the time of the survey, 47.9 per cent reported the month and year, 5.5 per cent reported the calendar year only, and 41.9 per cent reported the age at first marriage only. About 4.7 per cent of the ever married women failed to provide any information regarding the time of onset of first marriage. Among ever-married women aged 30 years and older, 24.3 per cent reported the month and year, 3.4 per cent the calendar year only, 65 per cent the age at marriage only and 7.3 per cent did not report any information about the date of their first marriage. The breakdown by age group of the proportion ever-married reporting month and year,

year only, age at marriage and those who did not report any information is given in Table 3.5.

Table 3.5 : Percentage Distribution of Ever Married Women by Age at Survey Reporting Date of Marriage.

age group	month + year	year only	age only	not reporting	ever married	never married
15-19	62.2	4.5	29.8	3.5	45.1	54.9
20-24	51.0	5.4	39.2	4.4	87.1	12.9
25-29	40.9	5.9	47.9	5.3	97.0	3.0
30-34	31.8	3.8	57.9	6.5	99.4	0.6
35-39	22.8	3.2	66.6	7.4	99.7	0.3
40-44	20.0	3.8	68.6	7.6	99.9	1.1
45-49	19.1	2.4	70.5	8.0	99.0	1.0
N.S	18.8	6.3	68.6	6.3	98.0	2.0
Total	29.3	3.7	48.6	5.4	87.0	13.0

The proportion reporting month plus year only declined with advancing age, and the proportion reporting age at marriage only and the proportion that failed to report any information about date of marriage increased with age. This suggests that younger women had better knowledge of their date of marriage than the older women, probably because of the recency of the date of marriage and also because of higher literacy among these group of women.

When the proportion who had reported the month and calendar year are examined for heaping on rounded calendar years ending in 0 or 5 and on years in which notable events took place, there appears to be some degree of concentration of marriages in particular months and years (see Figures 3.8(a) and 3.8(b)).

The distribution of ever-married women by calendar year of marriage shows an increasing trend up to 1971 with minor peaks in 1954, 1960, 1966 and 1970. After 1971, however, the distribution appears to be seriously distorted. It declined slightly in 1972 and then suddenly increased to a maximum peak in 1974. It then declined sharply in 1975 and increased moderately thereafter. In the absence of any heaping or social changes, the distribution of the proportion ever-married by year of marriage should show an increasing trend as more and more women enter marriage over time. The slight peaks and troughs before 1971 and that of 1974 may be due to the clustering of marriages around years with known historical events. For instance, 1960 was known for the widely publicized but aborted coup. Perhaps more importantly 1974 was the year when the government of Emperor Haile Selassie was overthrown.

The distribution of the proportion ever-married by month of marriage also shows massive peaks and troughs at particular months. January and April followed by May appear to be the months in which most women had married. Marriage was least frequent in March and during the rainy season from mid June to October. In a hypothetical population, one would expect a uniform distribution with about 8.3 per cent of the women marrying at each month from January to December.

The departure from uniformity in our data is mainly due to the seasonal character of marriage rather than due to misstatement of the month of marriage. In Ethiopia, as in most human populations, marriage has a seasonal pattern. Due to cultural, economic and social factors, marriage is usually confined to certain months of the year. January is the month following the harvest and people are economically better off, with sufficient cash from the sales of grain to arrange marriages while April is the month following the long fasting season (about two months of fasting for Christians during February and March) in which marriage is prohibited. Immediately after Easter the restrictions on marriages are relaxed and many marriages take place. From June onwards, fewer and fewer people marry because of economic reasons.

The data on age at first marriage shows that about 2.0 per cent of ever married women were married while they were under 10 years of age. Nearly 28 per cent while they were between 10 and 14 years, and about a quarter married at age 15, 23 per cent married between 16 and 17 years of age, 11.0 per cent between 18 and 19 and 4.3 per cent married at age 20 or over. (Note that for 5.7 per cent of the ever married women information regarding date or age at marriage was missing (see Table 3.5 above).) This shows that marriage is very early in the population, and that it is highly concentrated around age 15 (see Figure 3.9a).

Heaping on rounded or preferred ages may well have distorted the age at marriage data. However, it is difficult to detect this error because of the clustering of age at first marriage in a narrow band around age 15. Instead we will examine the data on years since first marriage for errors of heaping. Information on the number of years since first marriage was obtained by taking the difference between the date of interview and the date of first marriage or age at first marriage. Minor heaping is present at 5, 10, 15, 20, 25 and 30 years since marriage (see Figure 3.9(b)). The heaping is more pronounced at 10 and 20 years since first marriage, perhaps because of age heaping on age 15, 25 and 35. However, when grouped into five year age groups, the data appears fairly good (see Table 3.6).

Table 3.6 : Percentage Distribution of Ever Married Women by Five Years Duration Since Marriage

age group	per cent
0-4	11.3
5-9	15.1
10-14	19.3
15-19	17.8
20-24	17.0
25-29	11.9
30-34	7.5

There are higher proportions of women between 10-14, 15-19 and 20-24 years since marriage. The low proportions under 5 years since marriage are mainly due to the smaller number of married women at the younger age group while the lower proportions at 40-44 and 45-49 are due to the smaller cohort of older women.

Proportion Ever Married, and the Age at which 10, 25, 50 and 75 per cent of Women Married.

Misstatement of age at first marriage and the omission of marriages by older women may further be examined by looking at the proportion ever married by single year of age for each birth cohort, or the exact age at which a given proportion married, or the proportion ever married by 5-year periods before the survey by age at survey.

We have computed the cumulative proportion of the ever married women at successive ages of marriage, the ages at which 10, 25, 50 and 75 per cent married and also the proportion ever married by age group at 5-year intervals before the survey.

The proportion marrying at specified ages by birth cohort show a consistent increase for the younger cohorts at each successive age of marriage; for the older cohorts, it appears to be nearly constant. However, there are some trivial irregularities for the cohort aged 25-29 and 45-49 (see Figure 3.10). Among women aged 25-29 marrying at ages 13, 14, and 15, slightly lower proportions were married than the figures corresponding to the 20-24. This may indicate some misstatement of age at first marriage but since the difference between the proportions at 20-24 and 25-29 is very small, it may not cause marked distortions in the data. On the other hand, the proportion married at various ages is much smaller for those aged 45-49 than the 40-44 which may partly be due to the boundary effect that might have removed women from this age group to the next higher age group, and partly due to the omission of earlier marriages by the older women who were widowed or divorced.

The proportion ever married by cohort for 5-year periods before the survey (Table 3.7) and the age at which 10, 25, 50 and 75 per cent married (Table 3.8) also suggest better reporting of nuptiality data by the younger women. The proportion married at different periods (rows) show a consistent decline while the proportion married at the same period (columns) fluctuate especially for periods 15 or more years before the survey. The proportion married while in the same age group (diagonal from left to right) increase with period before the survey suggesting slight increase in age at first marriage (see Table 3.7).

Table 3.7 : Percentage Distribution of Ever Married Women by Age and 5-year Intervals Before Survey.

age	years before the survey						
group	0-4	5-9	10-14	15-19	20-24	25-29	30-34
15-19	34.6	5.9					
20-24	88.7	59.3	12.0				
25-29	96.8	92.0	65.1	9.8			
30-34	98.6	97.6	94.2	66.9	10.1		
35-39	99.8	99.8	98.1	93.5	67.6	10.0	
40-44	99.1	99.1	99.8	98.5	94.0	67.5	7.2
45-49	99.6	99.6	99.6	99.6	99.2	93.7	63.7
all	86.9	76.9	63.6	46.6	31.0	16.0	5.6

Table 3.8 : Age at which 10, 25, 50 and 75 per cent of Women Ever Married

age	per cent				
group	10	25	50	75	inter quartile range
15-19	14.6	16.5			
20-24	12.4	14.5	16.5		
25-29	12.3	13.8	15.8	18.3	4.5
30-34	11.9	13.8	15.2	17.0	3.2
35-39	11.9	13.6	15.2	16.9	3.3
40=44	11.7	13.6	15.1	16.6	3.0
45-49	11.7	13.4	15.1	17.1	3.7

The progressive decline with increasing age at survey up to age 30 of the age at which 10, 25, 50 and 75 per cent of the women married further confirms the above statement. For later ages however, there appears to be minor fluctuations implying again the existence of some distortion in the nuptiality data by the older women (see Table 3.8).

First Birth Interval

Examination of the first birth interval reveals distortions that may partly be due to the mis-reporting of the date of marriage or age at first marriage. Negative first birth intervals, intervals with lengths less than nine months, and extremely wide intervals, are all indicators of distortions in the data. Table 3.9 presents the distribution of first births by length of interval and age group of mothers.

From the table, it may be observed that 8.1 per cent of the first births were reported to have been born before the date of first marriage and 3.7 per cent at the time of first marriage. It may also be observed that the percentage of such births increased with increasing age of mothers. Such intervals may be characteristics of populations where pre-marital births are common. In Ethiopia, however, chastity for children of both sexes is a value strongly held by all ethnic and religious groups. As soon as a girl experiences her first menses, she is kept under close watch and she is not allowed to go away from home alone. She is also not permitted to associate with boys who are not her relatives. As a result, pre-marital sex is not allowed in the society. (However, among young females (under 25) in the major urban areas, especially in Addis Ababa and Asmara, there may be some births that occur in less than nine months after marriage.) As this survey did not include major urban areas, the negative intervals and intervals that are less than nine months may well be due to omission of earlier marriages and reporting the date of the recent marriage as date of first marriage by older women who were divorced or widowed and then remarried.

Apart from negative intervals and intervals of less than nine months, a little over 20 per cent of the first birth intervals were 60 months or longer. In a population where the use of birth control is virtually absent, such a wide first birth interval may also sometimes be due to misstatement of the date of marriage or first birth. It could also be due to adolescent sub-fecundity arising from young age at first marriage.

Table 3.9 : Percentage Distribution of First Births by Length of Interval and Age Group of Mothers: Women who reported complete dates of first birth only.

Age	Interval length in months								total
Group	< 0		0-8		9-59		60 +		births
15-19	2.6	(3)	0.9	(1)	94.7	(108)	1.8	(2)	114
20-24	5.9	(19)	1.3	(4)	88.8	(284)	4.1	(13)	320
25-29	7.8	(30)	2.3	(9)	80.6	(311)	9.3	(36)	386
30-34	9.2	(29)	3.5	(11)	66.8	(211)	20.5	(65)	316
35-39	9.0	(29)	5.0	(16)	46.9	(151)	39.1	(126)	322
40-44	10.2	(20)	6.1	(12)	45.2	(89)	38.5	(76)	197
45-49	11.2	(18)	9.3	(15)	39.8	(64)	39.8	(64)	161
Total	8.9	(148)	3.7	(68)	67.1	(1218)	21.0	(382)	1816

Note: Numbers in bracket are number of births.

We have seen in the previous section that about 35 per cent of ever married women had reported that they were married while under 15 years of age. This is because among these populations of Central Ethiopia, there are certain ethnic and religious groups who arrange marriage for their children while the children are very young, although living together (i.e. cohabitation) as husband and wife only starts at puberty. In such cases, some women when asked to report the age or date of first marriage, may have reported the date of the marriage agreement (i.e. betrothal) instead of the date on which they started living together as husband and wife. This might have caused such wide first birth intervals.

The omission of first births and reporting the date of birth of the second child as the date of first birth, or the displacement of the date of first birth closer to the date of the interview might also result in such wide first birth intervals.

Comparison with Data from External Sources

The quality of the nuptiality data collected in the M.O.H. survey is examined by comparing it with the 1981 rural demographic survey data on Arsi and Shoa obtained from the C.S.O. data tape. Proportions ever married were obtained by reconstructing marital distributions for 1981 from the M.O.H. data using information on date of marriage and age at first marriage. Table 3.10 shows the proportion ever married in 1981 from the C.S.O (1981) and the M.O.H. (1986) surveys. Except for age group 15-19, the values agree fairly well indicating that there was no serious distortion arising from the omission or misstatement of marital status.

Table 3.10 : Percentage Distribution of Ever Married Women According to 1981 Survey

age group	C.S.O. 1981	M.O.H.(reconstructed)
15-19	59.3	51.3
20-24	92.0	91.1
25-29	97.6	97.8
30-34	99.8	99.1
35-39	99.1	99.1
40-44	99.6	99.2

3.2.3 Fertility Data

The maternity history section of the individual questionnaire in the M.O.H. survey first collected information on children ever born using simple census type questions. It then collected data on the birth date, sex, survival status and if dead, age at death of each of a woman's live births in chronological order. These data together with additional data on women's dates of birth and marriage can be used to reconstruct age specific and duration specific fertility rates, not only for the recent past, but also for the remote past (i.e. up to 20 or 25 years before the survey).

However, as was pointed out earlier, fertility data collected in most demographic surveys are subject to errors of omission of live births and the displacement in time of the date of live births which may invalidate estimates of the levels and trends of fertility obtained from the data. Below we attempt to evaluate the maternity history data in order to detect the extent of these errors using internal consistency checks.

Reporting of the Date of Birth

The questionnaire on the date of birth of children included the day or saint's day, and the month and the year on which the birth occurred. Unlike WFS surveys, questions on the age of the child at interview or the age of the mother at the birth of the child were not included. However, for most births (over 94 %), either both month and year, or year of birth only, was reported. This is a much higher proportion compared to figures obtained for most of the African countries which participated in the WFS programme (see Goldman et al, 1985).

Table 3.11 presents the percentage of births by birth order for whom date of birth was reported as month plus year, year only, or not reported at all. It can be seen that the proportion of births for whom month and year of birth were reported does not change much with birth order except for the last and next to last births. For these births, however, a higher proportion had the date reported in month and year. This may be because these births had occurred recently compared to others. Table 3.11 also shows that the proportion of births for whom date of birth was not reported in any form declines with birth order.

Although dates of birth in one way or the other were obtained for over 94 per cent of total live births, there are various inconsistencies in these data. Blacker (1986), points out that because dates of birth are not generally known in Ethiopia, the information recorded in the birth history was subject to considerable error. He elaborates this point by citing cases where births that had occurred 15 or more years before the survey to women aged 15-19 at the time of the survey. In our examination of the dates of birth, we also noted similar cases. For instance, among births for whom dates were reported, 2.5 per cent were reported to have occurred beyond the maximum age of the mother, and 0.2 per cent before the minimum age. For 4.2 per cent of the births, the birth intervals were either negative or positive but less than the biological minimum.

These errors might have arisen from two sources. First, though women were asked to report their births in chronological order beginning with the first, they might have failed to do so primarily from lack of knowledge. Older women who sometimes do not remember the number of children they had born due to memory lapse, might have found it difficult to remember the parity of the birth, especially when the child had lived for a very brief period after its birth. As a result, reporting could be mixed up, and it appears that most of the negative values observed in the second and subsequent birth intervals were caused by this. Second, enumerators in the field or coders in the office might also have introduced such errors merely by a slip of proper vigilance.

Table 3.11 : Percentage Distribution of Reported Birth Dates by birth order.

birth order	month + year	year only	not reported
1	64.0	28.6	7.4
2	64.7	30.0	5.3
3	64.0	30.9	5.1
4	63.2	30.9	5.9
5	63.4	32.2	4.4
6	64.3	33.2	2.5
7	65.1	32.9	2.0
8	64.0	34.3	1.7
next to last	68.7	28.4	2.9
last birth	77.0	21.4	1.6
all births	64.6	29.5	5.9

Apart from these inconsistencies, the birth interval data indicates a substantial amount of heaping on multiples of 12, evidently arising from age of children being given in rounded durations at interview instead of date of birth. Figure 3.11 presents the percentage distribution of the first four birth intervals. Massive heaping on 12, 24, 36, 48 and 60 months is present as can be seen from Figure 3.11. A similar pattern was observed for intervals of higher orders as well.

Omission of Live Births

Omission of live births is a serious source of errors in fertility data affecting the levels and trends. It is believed to be related to the age and educational level of respondents. Older and uneducated women are more likely to omit some of their live births, especially those who were born a long time ago, who died shortly after birth, or who moved away from home. Absence of reliable external data makes it difficult to estimate the level of omission of live births in the M.O.H.

data. However, we will attempt to indicate the presence or absence of omission of live births by internal consistency checks.

In the absence of dramatic decline in the remote past or a recent rise in fertility, a plot of the mean number of children ever born by single years of age of women should form a smoothly increasing curve. Hence a simple method of detecting the extent of omission of live births is to examine the mean parity by single year of age of women.

Figure 3.12(a) presents the average number of children ever born by single years of age of women in the 1981 rural survey and the M.O.H. survey. From the figure, it may be observed that the mean parity values agree fairly well up to about age 30 and thereafter the values from the M.O.H. data appear to be much higher than those from the C.S.O.(1981) data. It may also be observed that the values from the M.O.H. survey show exceptional peaks at ages around 40 and 45 while those from the C.S.O. survey appear to be nearly flat around ages 40 to 44 indicating perhaps omission of some births.

The above average reported parity values at these ages may be due to errors of age reporting. As we have shown earlier, the age data suffered from heaping on ages ending in 0, 5 and to some extent 8 and that heaping was more pronounced at later ages. Consequently, some women from the older ages who would normally have higher parity might have been moved downwards to these ages. It is also important to note that the distortions above age 45 could be due to the combined influence of heaping on age 50 and the upper boundary effect.

However, it is interesting to note that distortion in the reported mean parity values by single year of age are not prevalent when the data are presented in 5-year age groups (see Table 3.12).

Alternatively, omission of live births may be detected by comparing the mean parity and the cumulated age specific fertility obtained from births in the preceding year in single years of age of women. In the absence of omission and errors of reference period, the cumulated fertility in single years of age reconstructed for the year preceding the survey from the birth history data should agree with the mean parity at the same age if fertility has been constant in the recent past (Goldman et al, 1985).

Table 3.12 : Children Ever Born, Children Dead and Sex Ratios by Age Group of Women.

age	Children ever born				Children dead				
group	total	M	F	S.R	Total	proprt.	M	F	S.R
15-19	0.36	0.19	0.18	1.07	0.27	15.1	0.14	0.19	1.08
20-24	1.78	0.92	0.86	1.06	0.53	16.8	0.28	0.25	1.12
25-29	3.16	1.63	1.53	1.06	0.74	17.3	0.39	0.35	1.11
30-34	4.27	2.26	2.02	1.12	1.14	20.6	0.61	0.54	1.13
35-39	5.52	2.92	2.61	1.12	1.29	20.4	0.70	0.60	1.17
40-44	6.34	3.32	3.02	1.097	1.44	22.1	0.77	0.68	1.16
45-49	6.51	3.43	3.08	1.113	1.56	22.3	0.83	0.73	1.14

Figure 3.12(b) displays the mean parity and the cumulated age specific fertility for the pre-survey year in single years of age. It may be observed from the figure that except for some minor variations, the two curves agree fairly well up to age 40. Beyond this age however, the cumulated age specific

fertility is higher than the mean parity values. This may be mainly due to errors of omission of children ever born or to misdating of births. Nevertheless, comparison of the mean parity values with those obtained from the 1981 survey show no serious omission of births in the M.O.H. survey. In fact the higher mean parity values in the M.O.H. data offer strong evidence of better reporting in the M.O.H. than in the 1981 C.S.O. survey (see Figure 3.12(a)). However, the possibility of omission of some births by older women cannot be ruled out as examination of the sex ratios of children ever born and the proportion of dead children indicate (see below).

In any society, the number of male births is higher than the number of female births and as a result the sex ratio at birth usually ranges between 103 and 107 male births to every 100 female births (Shryock et al, 1976). A substantial variation in the sex ratios can be taken as an indication of sex selective omission. If the sex ratio is much higher than the upper limit, it may be indicative of omission of female children and a value much lower than the lower limit would indicate omission of male children.

The data in Table 3.12 show that the sex ratios are within the acceptable range for the younger women. But for the older women, the ratios are higher perhaps indicating that older women who had their births a long time ago failed to report some of their female births. When the sex ratios are examined by 5-year period before the survey, they also show that there were some omission of female children born 15 or more years preceding the survey and that more and more female children were omitted the more distant the time period is from the survey date (see Table 3.13).

Table 3.13 : Sex Ratios of Births by 5-year Periods Before the Survey.

	Births			
Period	total	male	female	S.R.
0-4	3621	1847	1774	1.04
5-9	3667	1875	1792	1.05
10-14	2671	1361	1310	1.04
15-19	1491	775	716	1.08
20-24	737	384	353	1.09
25-29	292	157	135	1.16
30-34	77	42	35	1.20
total	12556	6441	6115	1.05

Omission of live births can also be examined by considering the proportion of children born alive who subsequently died. In the absence of rising infant and child mortality, one would expect the proportion of dead children to rise with the age of women as older women are more likely to have more children and their children have been exposed to the risk of death for a longer period than those of younger women, thus they would have more dead children. The proportion of dead children by 5-year age group of women presented in Table 3.12 show that the proportion increased with age. However, a slight shortage of the proportion of dead children for women aged 35-39 than those aged 30-34 is observed. This may be due to omission of some dead children by women aged 35-39. The sex ratios of dead children also presented in Table 3.12 show that the ratios though generally high because of the higher male than female mortality at all ages, are much higher at ages over 35 years confirming the suggestion that some female deaths by older women were not accounted for.

In general, as a result of the intensive interview and probing used, it appears that children ever born were better reported in the M.O.H. Survey than in the earlier survey.

Displacement of Date of Birth

As noted earlier, a major source of error in birth histories arises from the misdating of births. Date of birth may be displaced backwards into the remote past or forward towards the survey date (Brass, 1978). Backward displacement of date of birth results in exaggerated inter-birth intervals and higher fertility in the remote past, while forward displacement results in a concentration of births in an intermediate period closer to the date of the survey and thereby create a misleading impression of a rise in fertility and a subsequent decline. These errors are prevalent in most maternity history data and are related to the ages of women. Older women are more apt to displace the date of birth of their children born in the remote past than are younger women.

Though it is difficult to distinguish errors of misdating from errors of omission of births, an examination of the median age at first birth and period specific fertility rates by cohort suggests that in the M.O.H. birth history data misdating of births occurred.

Table 3.14 presents median ages at first birth for cohorts 15 through 49 by place of residence and literacy. In the absence of any change in the age at first birth, one would expect no change in the median age at first birth across cohorts. If there is any increase in the age at first birth, it should be reflected by higher values for the youngest cohort. However, the data in Table 3.14 depict a decline in the age at first birth. Although declines in the median ages at first birth have been observed in some countries during the 1970s (Benin, Cameroon, Ghana, Ivory cost, etc. (Goldman, et al, 1985)), the decline in the median ages in our data cannot be attributed to changing age at first birth. It is very likely that the decline in the mean age at first birth is partly due to omission of first births and reporting second births as first births (as first births are highly vulnerable to mortality risks, first children who have died might have been omitted) and partly due to displacement of the date of first birth.

Table 3.14 : Median Age at First Birth by Age Group, Residence and Literacy

age group	Rural	Urban	Illiterate	Literate
15-19	16.1	16.9	16.4	17.0
20-24	17.7	18.0	18.0	17.7
25-29	19.1	19.4	19.3	19.7
30-34	19.8	20.5	20.1	20.5
35-39	20.4	21.3	20.8	21.2
40-44	20.6	21.0	21.0	20.4
45-49	21.9	22.3	22.3	22.5

Table 3.15 presents cohort-period fertility rates, cumulative cohort-period fertilities and P/F ratios. Rates corresponding to different cohorts at the same age group are found along a row while rates for a given cohort at different

ages are found up the diagonal of Table 3.15 panel A. Cohort-period rates cumulated over time for each cohort are presented in Panel B. These values correspond to the mean parity that each cohort had achieved at the end of each period. The rates cumulated over cohorts for each period are presented in panel C and the P/F ratios in panel D. Note that these rates were computed for cases with complete information on dates of events (i.e., the 1,070 questionnaires with missing, incomplete or inconsistent dates were excluded from the calculation of the rates).

The rates presented in panel A increase starting from the remote past up to 5-9 years before the survey and then decline for the most recent five year period. This is also reflected in the cumulated fertility figures for real cohorts in panel B as well as for cumulated period rates in panel C. In panel B, it may be seen that older cohorts had fewer births at specified ages than younger cohorts. For example, the cohort aged 45-49 at the time of the survey had 0.582 fewer births per woman when they were aged 20-24 years than the cohort aged 35-39 at the same age and 0.116 fewer births per woman than those aged 40-44 at the time of the survey. The cumulated period rates in panel C show exactly identical pattern with the age specific rates presented in panel A.

Table 3.15 : Cohort-Period Rates, Cumulative Cohort and Period Fertility and P/F Ratios by Age at Survey.

age group of cohort at end of period	years prior to survey							
	N	0-4	5-9	10-14	15-19	20-24	25-29	30-34
A	period - cohort specific fertility rates							
10-14	14	0.022	0.006	0.013	0.007	0.006	0.003	0.003
15-19	503	0.054	0.090	0.072	0.051	0.035	0.035	0.036
20-24	410	0.234	0.243	0.209	0.145	0.137	0.116	
25-29	371	0.289	0.291	0.272	0.209	0.168		
30-34	345	0.257	0.309	0.297	0.227			
35-39	361	0.245	0.281	0.287				
40-44	199	0.184	0.239					
45-49	158	0.104						
B	cumulative fertility of cohort at end of period (P)							
10-14		0.111	0.139	0.129	0.067	0.047	0.023	0.019
15-19		0.409	0.578	0.426	0.304	0.200	0.196	0.186
20-24		1.748	1.612	0.923	1.347	0.881	0.765	
25-29		3.087	2.801	2.282	1.925	1.604		
30-34		4.086	3.829	3.412	2.737			
35-39		5.052	4.815	4.172				
40-44		5.735	5.365					
45-49		5.884						
C	cumulative fertility within period (F)							
10-14		0.111	0.123	0.100	0.081	0.087	0.051	0.064
15-19		0.382	0.481	0.460	0.338	0.264	0.228	0.243
20-24		1.552	1.697	1.503	1.061	0.949	0.807	
25-29		2.997	3.151	2.862	2.105	1.787		
30-34		4.282	4.698	4.348	3.239			
35-39		5.505	6.101	5.783				
40-44		6.425	7.294					
45-49		6.944						
D	P/F ratios							
10-14		1.000	1.130	1.289	0.826	0.537	0.457	0.300
15-19		1.073	1.201	0.928	0.899	0.758	0.860	0.764
20-24		1.127	0.968	0.896	0.870	0.929	0.948	
25-29		1.030	0.889	0.797	0.915	0.897		
30-34		0.954	0.815	0.785	0.845			
35-39		0.918	0.789	0.721				
40-44		0.893	0.736					
45-49		0.847						

Such trends in fertility may be due to omission of live births, misdating of births or due to increasing fertility. However, it is difficult to distinguish between these based on data from a single survey. For instance, the apparently increasing cumulated cohort rates for younger women may be due to real increase in fertility while the smaller values at specified ages for the cohort aged 35 years and over may be due to omission of live births or date displacement of births or a combination of both. Also the peak values of the age specific rates (panel A) and the cumulated period rates (panel C) for the period 5-9 years before the survey followed by a decline for the most recent period (0-4 years) before the survey may suggest what is commonly known as 'Potter effect' (potter, 1977). However, as we shall show in Chapter Five, such a pattern may be caused by past fertility increases followed by recent decline rather than displacement of dates of live birth alone.

The displacement of the date of live birth can also be examined by considering the P/F ratios by period before the survey. Although the P/F ratio procedure was originally developed by Brass (1964) as a method for estimating current fertility using data on children ever born and births during the 12 months preceding the survey together with a model age specific fertility curve, it has been refined by many demographers (including Brass himself) since its invention and has frequently been used as a diagnostic screening tool for the detection of trends and errors of omission and misdating of births (Brass,1971; Booth, 1979; Hobcraft et al, 1983; U.N., 1983). The technique involves a comparison of the cumulated cohort fertility up to the current age with the corresponding measures calculated from the period rates for synthetic cohorts (Brass, 1980).

If fertility is assumed constant, and if there are no errors of any kind in the data, the ratios will lie around unity for all cohorts. If however, the assumption of constant fertility in the recent past is violated or when there are errors of omission or displacement of dates of births in the data, the ratios will depart from unity.

The P/F ratios for various periods before the survey presented in panel D of Table 3.15 show that for the most recent period and the younger cohorts (15-29), the ratios are higher than unity and that the ratios decrease with age of the cohort. The drop in the ratios corresponding to the cohort 45-49 during the period 0-4 years before the survey suggest omission of some births. The successive values of the P/F ratios for previous periods indicate that fertility rise was followed by a decline in the most recent period. It may be argued that the lower values of the ratios for the older cohort and previous periods may be a combination of various factors such as displacement of date of birth and omission of children ever born. However, the slump in the ratios for the period 10-14 years before the survey for the older cohort (those aged 30 years and over) provides evidence of displacement of some of the date of births. It may also be observed from Table 3.15 panel D that the P/F ratios for the first age group (i.e., 10-14) are not equal to unity. This is mainly because of births reported to have occurred before the minimum possible age of childbearing.

From the foregoing, it may be concluded that the combination of rising fertility, omission and misdating of births have caused the anomalies in the fertility estimates presented in Table 3.15.

3.3.Summary and Conclusion

Attempt has been made to evaluate the age, nuptiality and fertility data collected in the M.O.H. survey. The evaluation aimed at pinpointing the probable sources of errors and biases and assess their magnitude. As there was no reliable external data source, the evaluation was mainly based on internal consistency checks.

The data on age show that age reporting was very poor both in the household and individual schedules. A substantial amount of heaping on ages ending in 0, 5 and 8 and avoidance of almost all the other digits was noticed. The saw edged pattern of the age distribution resulting from heaping does not disappear completely even when the data are grouped into 5-year age groups. Apart from heaping the lower and upper eligible age groups were affected by boundary effects.

The nuptiality data indicate slight distortions in reporting the timing of the onset of marriage. There was some degree of heaping on rounded years or on years on which important social events took place. A massive concentration of marriages around age 15 was observed and data on years since first marriage also show some heaping on multiples of

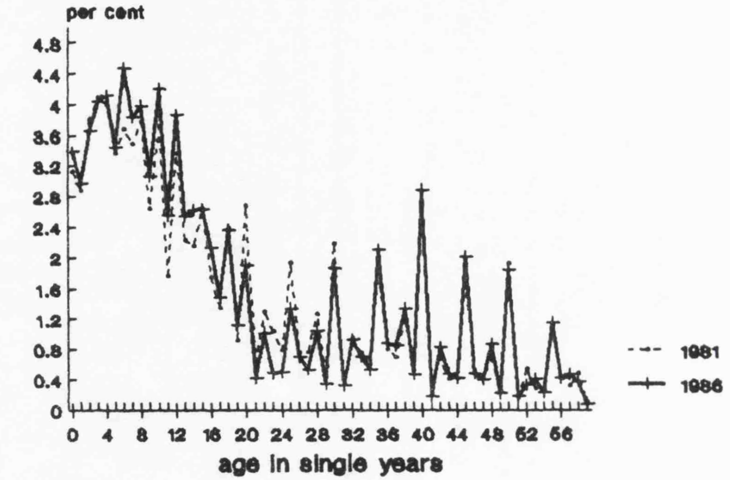
5. However, when 5-year groups were used, the data on years since marriage show a reasonable pattern. Proportion ever married by age group and period do not indicate presence of substantial omission of marriages or displacement of marriage dates although negative as well as extremely long first birth intervals resulting probably from erroneous reporting of date of marriage or date of first birth were present. The decline in the proportion ever married and the slight rise in the median age at first marriage among the younger cohort may be genuine and could have been brought about by modernization and increasing school attendance by the younger females.

The reporting of live births appears to be adequate if not complete for women under 40 years of age. Even for those over 40, children ever born were better reported when compared with the 1981 survey data. However, there were indications of some sex selective omission especially of dead female children of the older women.

The proportion of total births with date of birth reported is higher than would be expected in such a population where certification of events is virtually absent and the level of education is extremely low (only a quarter of the sampled women were literate). However, inconsistencies of various kinds were noted in the data. Birth intervals were negative or shorter than the biological minimum for some of the second and subsequent births. Also heaping on multiples of six months resulting from the reporting of the age of children in rounded years instead of the date of birth was substantial. Apart from these, period-cohort fertility estimates and the corresponding P/F ratios revealed the existence of forward displacement of dates of birth for some of the children born by the older women. In general, it appears that the birth history data is more distorted by errors of respondents age misreporting and misdating of births than by errors of omission of children ever born.

In conclusion, coverage of events was found to be relatively adequate if not complete while the dating of events was found to be poor. However, once the missing, incomplete and inconsistent dates are adjusted, the resulting estimates of fertility can be considered reliable if they are presented by broad age or duration groups and period before the survey. Broad groups may encompass some of the periods during which the event have been displaced. In this context, more reliable estimates may be obtained for five year age or duration and period groups than for single year groups. Though the problem of age reporting is one that characterises many non-literate populations, it calls for innovative techniques and perhaps better training of the field staff. The lack of external source of similar data with which the M.O.H. data could be compared reinforces the felt need for more surveys of this kind.

Figure 3.1a Percentage Distribution of Male Population in Single Years



Arsi and Shoa

Figure 3.2 : Indices of Age Heaping Arsi and Shoa (Male and Female)

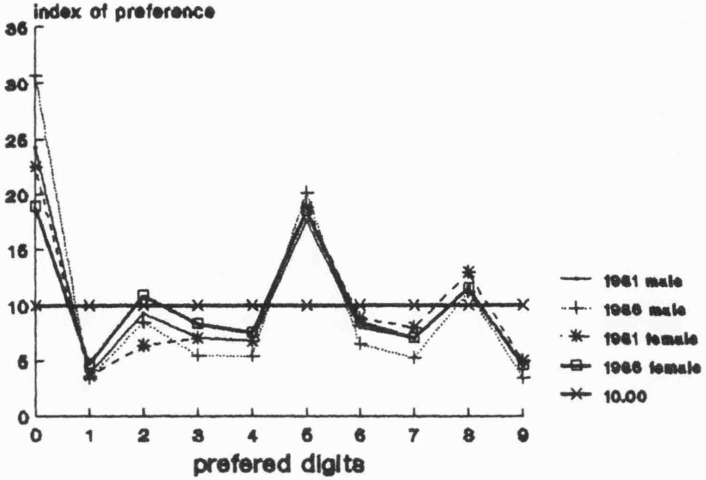
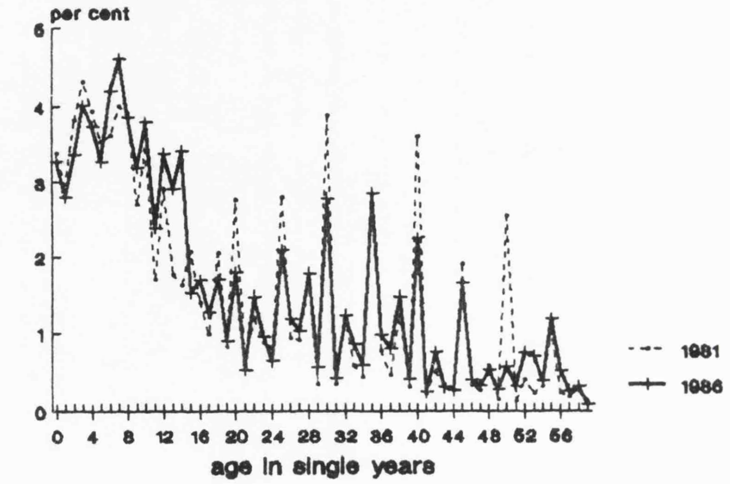


Figure 3.1b Percentage Distribution of Female Population in Single Years



Arsi and Shoa

figure 3.3a : Five year age distribution Arsi and Shoa (Male)

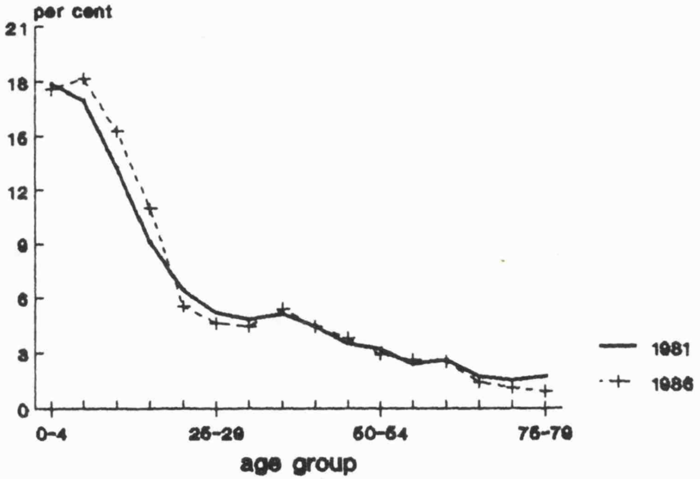


figure 3.3b : Five year age distribution
Arai and Shoa (Female)

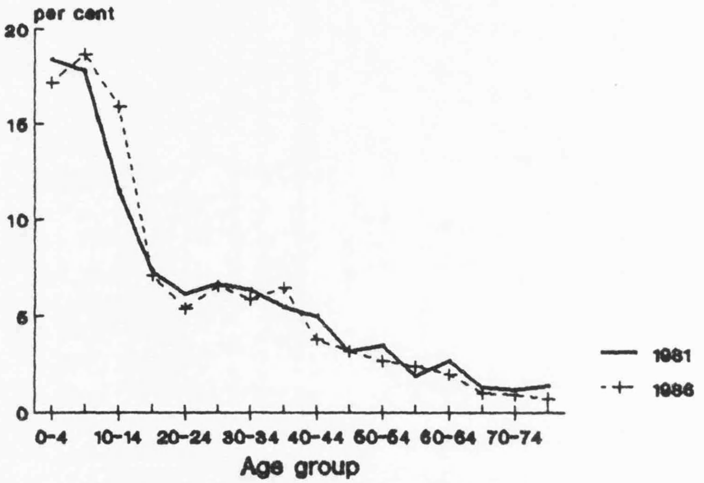


Figure 3.6 : Sex ratios (1981 and 1986)
Arai and Shoa

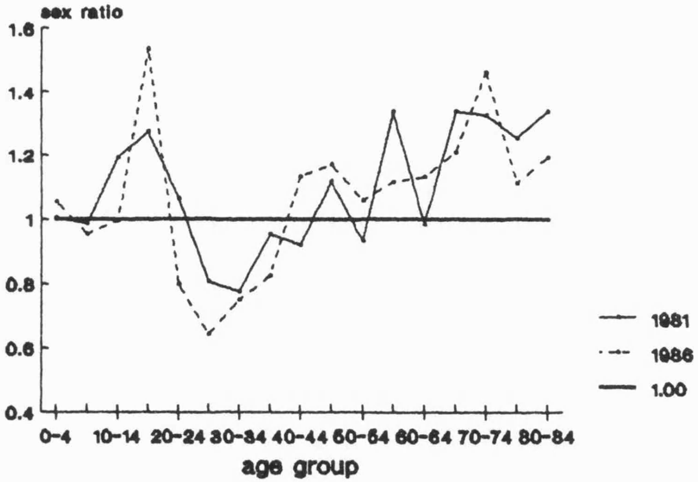
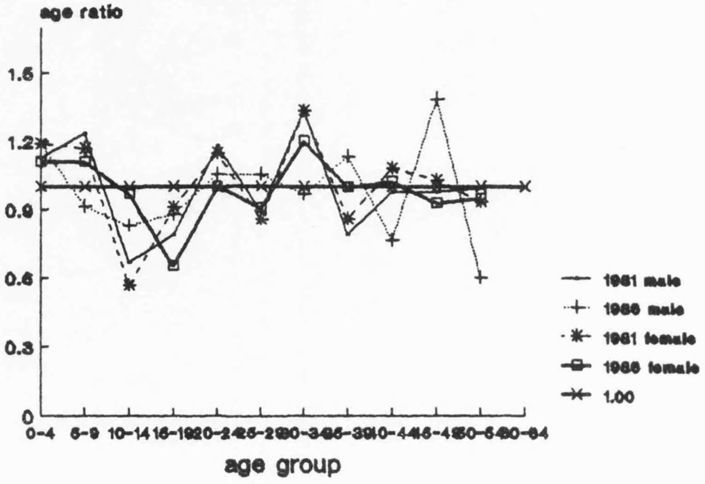


Figure 3.4 : Male and Female Age Ratios:
Arai and Shoa (1981 and 1986)



Source: C.S.O (1981), M.O.H.(1986)

Figure 3.7: Women Aged 15-50 in single
years (individual questionnaire)

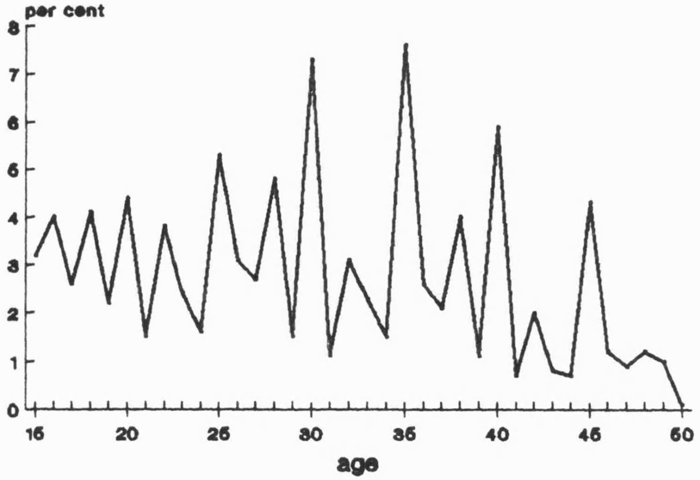


FIGURE 3.5a : M.O.H. 1986 AGE-SEX DISTRIBUTION: ARSI & SHOA

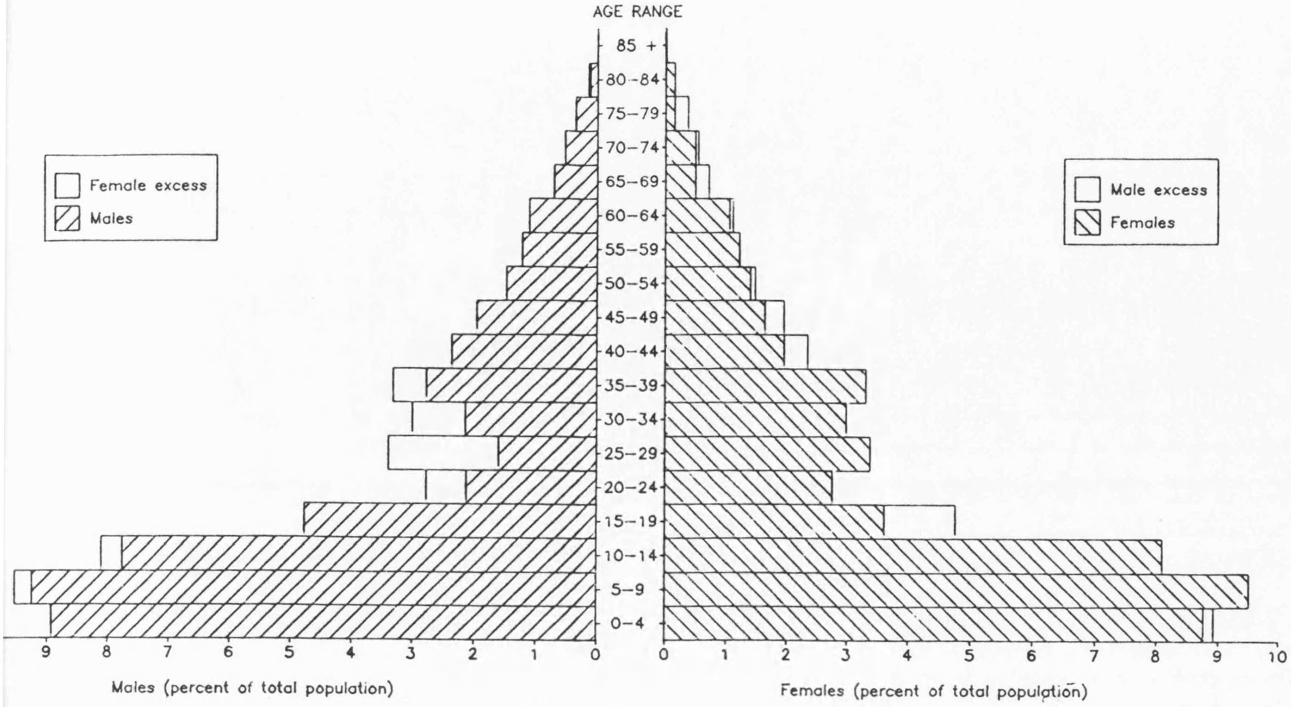


FIGURE 3.5b : 1981 C.S.O. SURVEY AGE-SEX PYRAMID : ARSI AND SHEWA

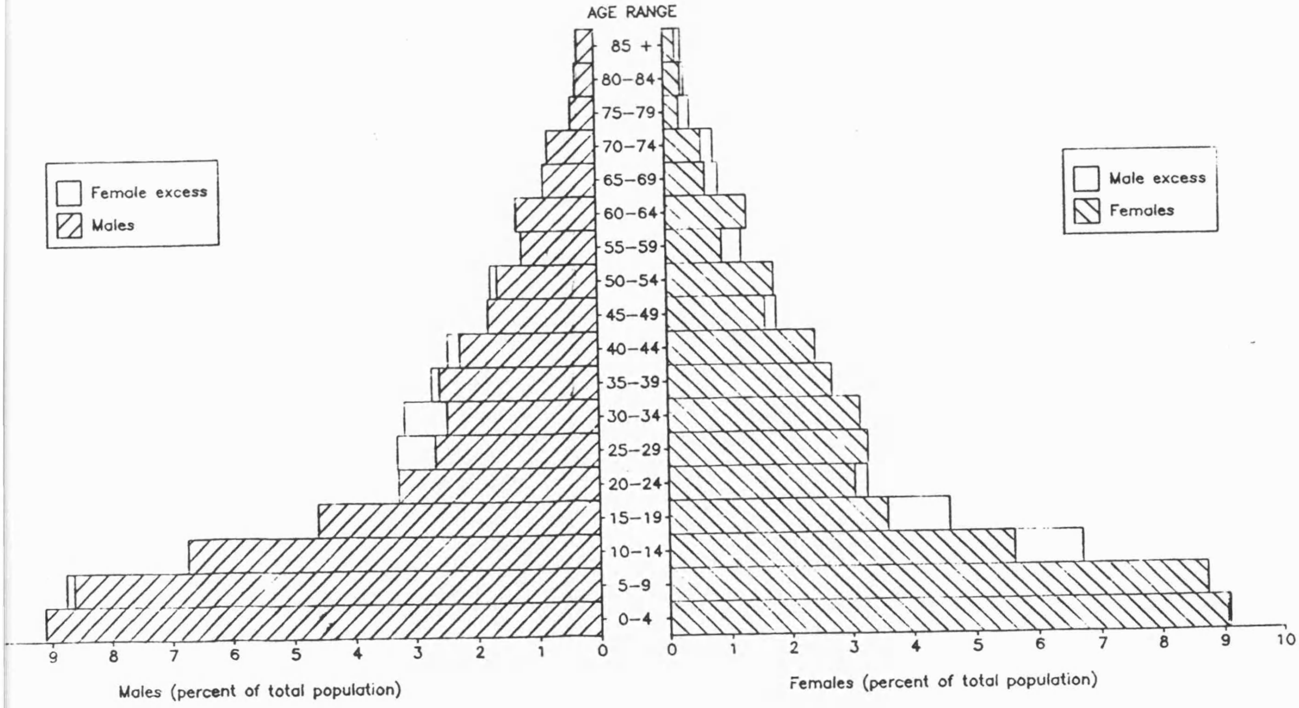


Figure 3.8a : Percentage Distribution of Ever married women by calendar year of marriage

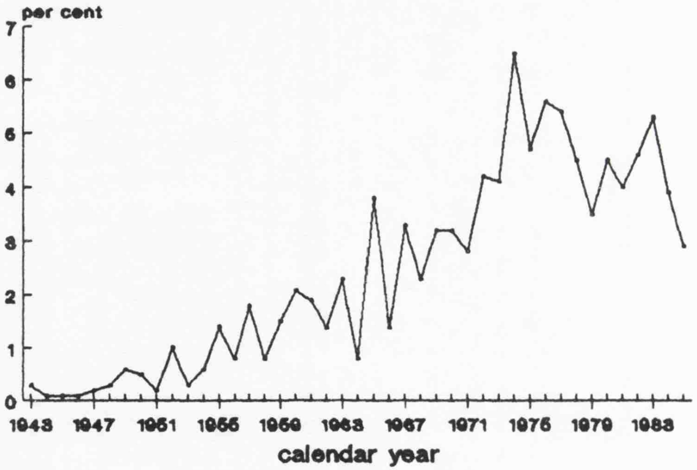


Figure 3.8b : Percentage distribution of ever married women by month of marriage

Figure 3.9a : Percentage Distribution of Ever married Women by age at Marriage

Figure 3.9b : Percentage distribution of ever married women by duration of marriage

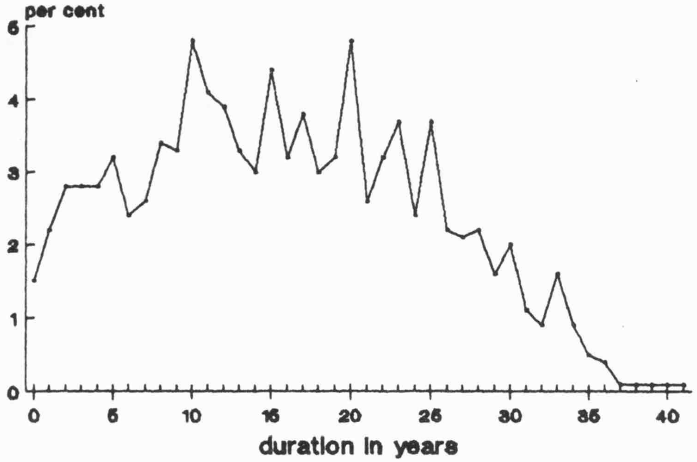


Figure 3.10 : Cumulative Proportion ever married women by age and birth cohort

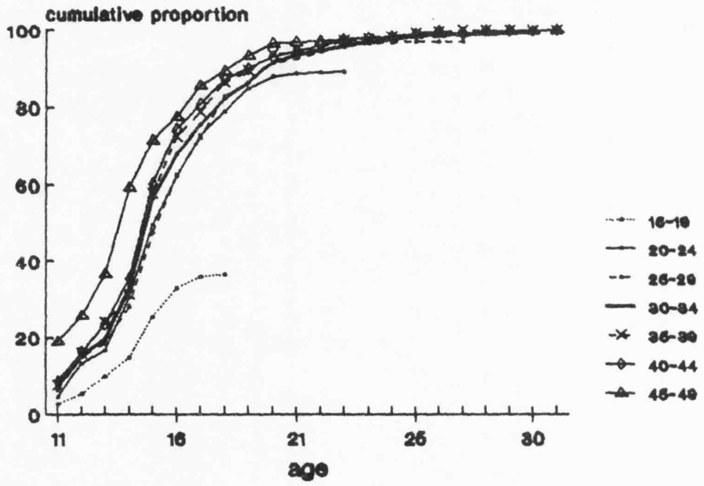


Figure 3.11b : Second birth intervals (raw data)

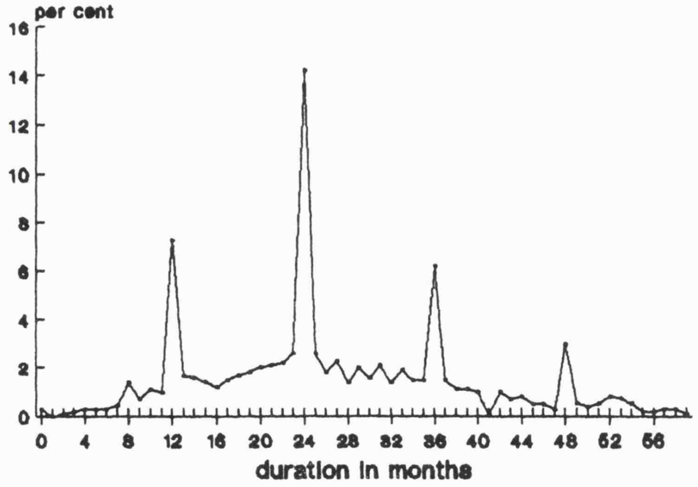


Figure 3.11a : First birth intervals (raw data)

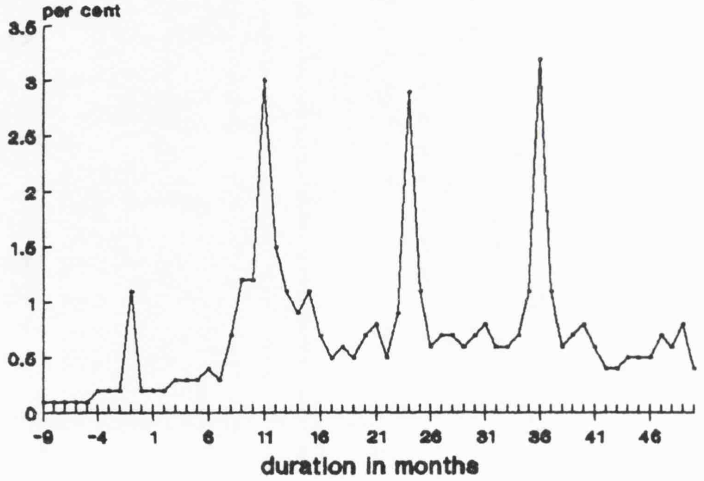
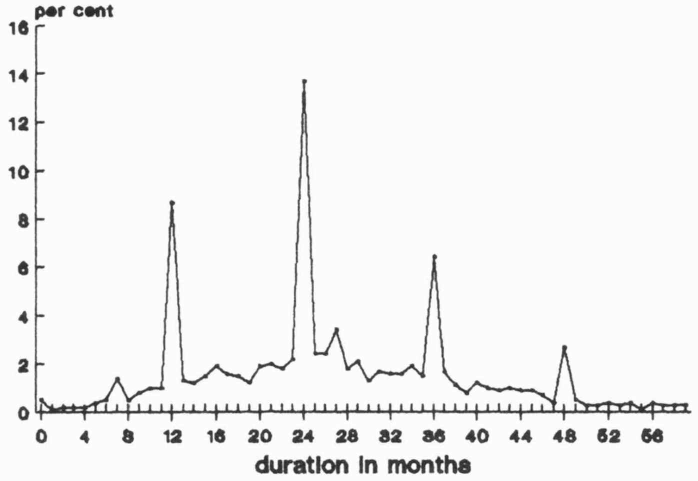


Figure 3.11c : Third birth intervals (raw data)



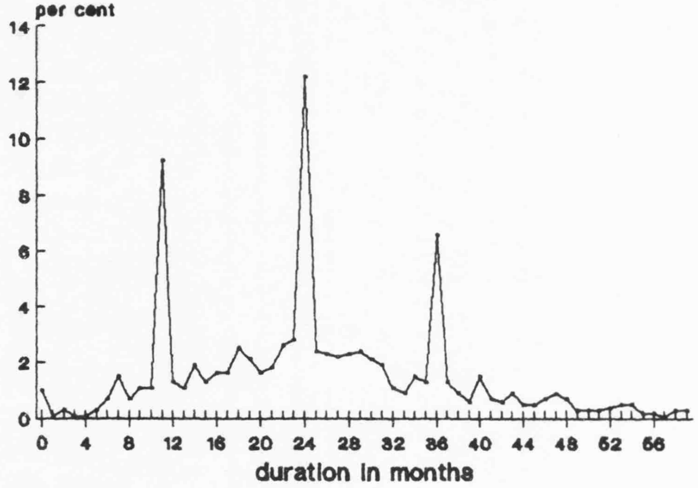


Figure 3.11d : Fourth birth intervals (raw data)

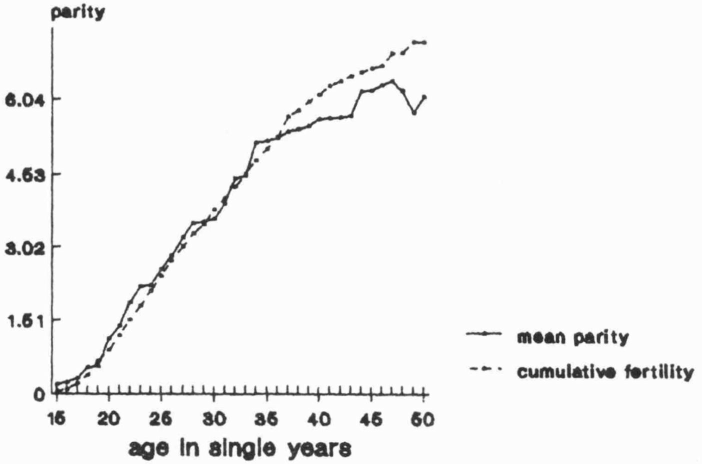


Figure 3.12b: Mean Parity and Cumulated Fertility by age of women :Arsi and Shoa (1986)

Figure 3.12a : Children ever born by age of mother : Arsi and Shoa (Rural)

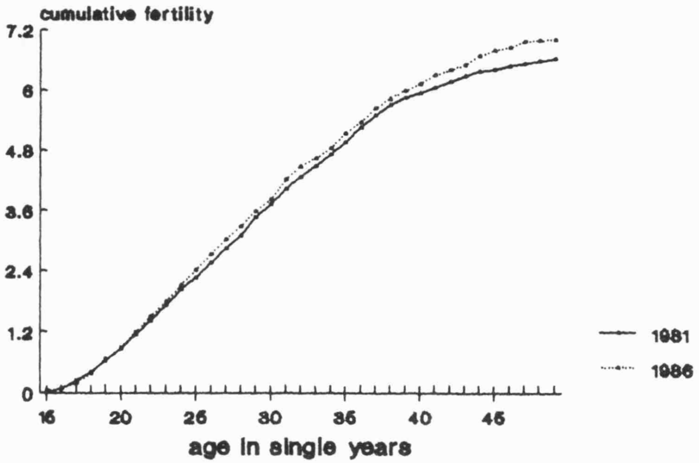


Figure 3.12c : 1981 and 1986 Cumulative Fertility by age of women Rural Arsi and Shoa

CHAPTER IV

IMPUTATION OF OMITTED, PARTIAL OR INCONSISTENT DATES

4.1. Introduction

In the evaluation of the quality of the M.O.H. data in Chapter Three, we have shown that the data suffered from the failure to report the dates of occurrences of events correctly. It was noted that for a substantial number of the ever married women, the date of first marriage was not reported correctly. Also for a little less than 13 per cent of the births, the dates were omitted, partially reported (for example, reporting the calendar year only), or they were inconsistent (negative intervals, impossibly short intervals between births, etc.). In general, there were a total of 1,070 questionnaires (a little less than one third of the completed questionnaires) with missing, partial or inconsistent dates.

In the face of these missing and inconsistent dates, it becomes extremely difficult to arrive at reasonable estimates of the levels and trends of fertility and to establish fertility differentials among the socio-economic subgroups of the population of Central Ethiopia. Omission of cases with missing or inconsistent dates from the analysis, as we shall show later in this chapter, leads to a substantial reduction in the sample size and makes cross classifications by age and socio-economic variables difficult. Moreover, the estimates of fertility levels obtained could be biased because women who failed to report dates, or those who reported partial or inconsistent dates were usually older women who were illiterate and had larger numbers of births than those who reported the dates with some degree of accuracy. If these women are omitted from the analysis, the resulting estimates of fertility may lead to a wrong impression of the past trends of fertility and also existing differentials may be hidden. Hence, it is crucially important to make a reasonable adjustment for the omitted, partial or inconsistent dates in order to arrive at plausible estimates of the levels and trends of fertility and to document the existence of differentials of fertility in the population.

In this chapter, we attempt to make adjustments for missing, partial or inconsistent dates using a special purpose program (DEIR - date edit and imputation program) prepared by the World Fertility Survey. But first we attempt to review the problems and proposed solutions of missing data. We then discuss the imputation of our data using DEIR and compare the imputed data with the raw (unimputed) data to show the effect of imputation on the data.

4.2. Nonresponse

In many censuses and surveys, interviewers may fail to contact units - households, individuals, etc., or units contacted may not be willing to be interviewed. It may also happen that units willing to co-operate may fail to answer some of the questions. In both cases some or all of the data that were intended to be collected from each unit are not collected. In the words of Rubin (1987), such nonresponse is called 'survey nonresponse' whether it arises from censuses or sample surveys.

Two types of nonresponses have been identified in the literature - unit (total) nonresponse and item (partial) nonresponse (Little, 1988; Rubin 1987; Kalton, 1983).

Unit (total) nonresponse occurs when no information is collected from a sampled unit. It may arise when the respondent refuses to be interviewed; when the interviewer fails to find the respondent, or when the completed questionnaire is lost. Item (partial) nonresponse occurs when the unit interviewed fails to provide answers to some of the questions (Sande, 1982). It may crop up when the interviewee lacks the necessary information to answer the question; when the question asked is sensitive (for example, questions on abstinence and amenorrhoea are not answered by most respondents in demographic surveys in developing countries), or when the required information is irrelevant from the respondent's perception of the survey objective.

Item nonresponse may also occur where missing data arise from the processing of information provided by responding units rather than the refusal of units to provide information. For instance, a response may be rejected at an edit check on the ground that it includes an inconsistency arising from a coding or punching error (Kalton, 1983).

4.2.1. Problems of Nonresponse

It is a known fact that nonresponse, whether unit nonresponse or item nonresponse presents two major problems.

First nonrespondents differ from respondents in many ways and as a result distort the representativeness of the responding sample. Second, nonresponse diminishes the effective sample size and leads to estimates that are not efficient.

In large surveys, under normal conditions, the magnitude of unit nonresponse, as measured by the proportion of nonrespondents to the total sample size is not much compared to item nonresponse. It is uncommon to observe total nonresponse of more than 5 per cent in a well designed survey. As a result, its effect on the efficiency of the estimators and the bias it may introduce is not as serious as in item nonresponse and in most cases, it is ignored and the analysis is limited to the responding units only.

In situations where it is known that a substantial proportion of the respondents were not contacted, or failed to provide any information and where these nonrespondents are different from those interviewed, unit nonresponse may lead to a serious bias. Nonetheless, compensation can be made by some sort of weighting adjustment (Kalton, 1983; Rubin, 1987).

The problem with item nonresponse - missing values for some of the observations is more serious and in recent years there has been a growing amount of theoretical and empirical work done in this area. The recent work by the National Academy of Science Panel on Incomplete data is an important source of literature in this area (see Madow et al 1983). Extensive discussions and suggestions of solutions regarding item nonresponse have also been offered by Rubin 1987; Kalton 1983; Kalton and Kasprzyk, 1986; Roger et al , 1978 and others. Missing data in some of the variables of interest present two major problems in survey data analysis. First, analysis of data with missing values is not easy because standard complete-data methods cannot be applied to analyse the data. For instance, procedures like multiple regression and discriminant analysis cannot be applied automatically to analyse the data because such procedures require a value for every case and failure to use standard procedures may lead to loss of general acceptance of statistical conclusions and general understanding of substantive conclusions (Rubin, 1987). Second, they lead to seriously biased and inefficient estimates. As Deming (1950) expressed it, with regard to human populations, 'The people who do not respond are in some ways and in varying degrees different from those who do.', estimated parameters may have biases of unknown size and direction. Jackson (1968), points out that lack of knowledge of the distribution function of the variables of interest further complicates the problem. He argues that the dependent variable can have dichotomous and categorical as well as continuous data which may or may not be normally distributed and in such circumstances, the estimated parameters are inefficient and biased. Thus it is desirable to make some sort of adjustment to missing data before carrying out the analysis.

In what follows, we shall be concerned with methods of handling item (partial) nonresponse, that is the situation where a co-operating individual fails or refuses to provide some specific items of information.

4.2.2. Methods of Handling Nonresponse

If nonresponses are discovered at the initial data edit checks, nonresponse can be handled by either consulting the questionnaire in the hope that it is correct and the non-response was caused by errors of coding, or errors introduced while the data were converted to machine readable form; or the original respondents may be contacted to obtain the correct response, or verify that the reported response was correct in its original form (Fellegi and Holt, 1976). However, this is not always possible because problems with the data are sometimes discovered when the survey processing is well advanced and it is too late to stop the process and also when the proportion of cases with missing data is large, the additional cost of contacting the respondents for verification could be substantial. Moreover, missing data might have occurred due to ignorance of what was asked as is usually the case in surveys in developing countries. For instance, in demographic surveys, nonresponses of dates of events (births, deaths, marriages, etc.) arise from lack of knowledge of the date of the occurrence of the event and cannot be corrected even when the respondent is contacted. Consequently, other methods of handling nonresponse are usually applied to the data.

The simplest method is to ignore cases with missing values and limit the analysis to complete responses. This may however result in a loss of a great deal of the data since many records may be affected. As the variance of an estimator is inversely proportional to the sample size, the estimates of population parameters will have larger variances as a result of reduced sample size due to omission of cases with missing values. Moreover, in situations where it is believed that respondents and nonrespondents differ, estimates of population means and totals can be seriously biased. As a result, this procedure is not a satisfactory way of handling nonresponse.

Another approach to handling missing data problem is to drop variables with missing data instead of cases and limit the analysis to variables with non-missing data. This may be a better approach if it is known that the contribution of the variable is negligible. But data are collected on variables because of their importance and in most cases a variable explains the variation in the dependent variable. Moreover, in situations where values of variables that are related are missing, the available partial information cannot be utilised. For instance, in birth history data where the date of birth is composed of the month and calendar year, if either the month or the year is missing, the available information may not be utilised and the date of birth may not be obtained in century month code (January 1, 1900 equals 1 in century month code).

In general, the above methods of handling missing data have some serious problems. First, if the reasons for non-response are correlated with the values of the variables, which is usually the case, the estimated parameters may be biased (Rubin, 1987). For instance, if nonresponse of the dates of events in maternity histories is related to literacy, residence, etc., estimates of demographic parameters such as age at first marriage, age at first birth, or the estimates of fertility will be biased. Second, limiting the analysis to the responding cases, or to variables with non-missing values alone reduces the sample size and this could easily lead to an expanded standard error of estimates. Third, the estimation of parameters may require a complex algorithm that takes too much computing time, and finally, none of these procedures are statistical in nature. As a result, other methods which overcome these shortcomings are used in handling problems of item nonresponse.

4.3. Imputation

Imputation is the most commonly used method of handling item nonresponse in surveys. It is the process of estimating individual missing items and assigning values for them. In other words, imputation makes the incomplete data complete by filling the blanks with plausible (realistic) values. It overcomes the problem of reduced sample size and allows the analysis to be carried out on all cases in the sample. This permits the use of standard complete data methods to analyse the data. All the usual population parameters (means, totals, ratios, differences, proportions, correlations, etc.) can be estimated easily although possibly without specified precision, that is, the precision of these estimates cannot be predicted on the basis of the sample design. Furthermore, it makes the presentation of results simple because there is no need of determining the different sets of cases with missing data that have to be deleted from different analysis, nor a need to provide details of the extent and treatment of missing data with each set of results (Kalton, 1983). Also the results obtained from different analysis are bound to be consistent with one another when imputed data are used compared with those from the incomplete data set. In addition, it saves the amount of computing time needed to estimate parameters as there is no need for complex algorithms to make estimates when complete data are used.

However, imputation also has some limitations. As Kalton (1983) reports, since imputation merely fabricates values for missing data, it does not generate additional information. In addition, there is no guarantee that the resulting set of estimates would be as consistent as estimates obtained from complete data set. Sande (1982), also reports that the use of imputed data in obtaining estimates of population parameters will make the estimates less reliable than if they were based on a complete set of real data, that is, the usual estimates of variance are inadequate since they do not include the error due to imputation.

Another important counterargument to imputation is that individual users generally analyse the filled in data as if they were complete, ignoring the fact that some values are imputed. This practice can lead to biased estimates of bivariate and multivariate parameters such as correlations (Santos, 1981) and it may result in an over estimation of the precision. As a result, it is usually recommended that the imputation should be flagged so as to warn individual users and also to allow them apply their own approach to handling missing data (Rubin 1987; Sande, 1981). However, machine imputed data are seldom flagged (Hobcraft and Murphy, 1986).

In general, imputation is a general purpose strategy good for many forms of analysis but not optimal. As Roger et al (1982) suggests, the best solution to the problem of missing data is to obtain the missing components. However, it is not possible to recover data lost during data collection and one ends up by attempting to estimate the values in question. Moreover, when the proportion of cases or variables on which imputation is to be applied is small, the risk of imputation is small (Kalton, 1983). Consequently, it is recommended that procedures that impute values which are consistent with the edits, which reduce the nonresponse bias and which preserve the relationship between variables be used for imputing missing data (Sande, 1982; Rubin 1987). For a brief discussion of some of the methods of imputation see Appendix 2.

Most of the available methods of imputation are special purpose methods. They were developed for imputing labour force items such as income, hourly wages, etc. Some of them are based on past data (cold deck procedure) and others use current survey data, but they are based on classification of records into imputation classes and matching (see Appendix 2) which is not possible in birth history data. Reproductive behaviour differs among women and it may not be easy to obtain donors that match in characteristics such as fecundity, duration of breastfeeding, abstinence and the like. Birth intervals vary from individual to individual due to genetic make up, fecundity status, breastfeeding, abstinence, birth order, etc. and it is difficult to match or classify women on the basis of these variables because in most cases these variables are not collected, or if collected, they are inaccurate.

4.4. DEIR - Date Edit, Imputation and Recoding

It is a known practice to find cases with missing, partial or inconsistent dates in event histories from developing countries. In non-literate cultures where the importance of calendar date in the day to day life of the population is minimum, women usually do not remember the dates of occurrences of events (dates of birth, death, marriage, etc.). As a result, for some respondents, the response to questions involving dates may not be reported at all, or if reported it may be partial or inaccurate. In most event history surveys, dates were reported in the form of years ago, or the age of the respondent at the event is given instead of the exact date of the event. If the date is not given, this obviously leads to missing date and if it is given partially, or in years ago form, the date of an event in century month code cannot be obtained. It sometimes occurs that even the reported dates are not consistent. In some surveys, cases such as a woman aged 15 at survey reporting a birth 10 or more years before the survey, or the length of time between births being smaller than the minimum possible interval have been noticed. In such cases, the event history data is said to be inaccurate.

We have stated earlier in this chapter that individuals who do not respond or who respond incorrectly differ from those who do correctly in a variety of characteristics (for example in educational background, place of residence, religion, etc.) and that estimates of population parameters based on those individuals who provide correct information are subject to biases of unknown magnitude and direction.

The presence of a substantial number of cases with missing, partial or inconsistent dates in most of the WFS surveys and the danger of limiting analysis to those with correct dates only, forced the WFS Central Office to develop a standard software which was refined and improved over a period of several years leading to the creation of DEIR - Date Edit, Imputation and Recoding program (Otto, 1980; WFS, 1984). A detailed discussion of the DEIR software is given in the WFS Basic Documentation, Software User's Guide, (WFS, 1984). In this section we attempt to present a brief discussion of the various facilities of the program.

DEIR requires an impute file containing dates of events, a user supplied hierarchy of information types and constraints. The input file is created by a questionnaire specific program which extracts the history information and related data from the original raw data file and rectangularizes it (Rowe and Croft, 1987). The date of events may be given in any one of the following four forms: (i) month and year of event (Type I data), (ii) Years since the event occurred (Type II data), (iii) Age of respondent at event (Type III data), and (iv) Age at interview (Type IV data). In addition to the four data types, intervals in months for the previous birth, or marriage, are collected in some of the WFS surveys and these may also be employed by DEIR. The constraints include information on the minimum possible age to have a child, the minimum possible interval between births, etc. and information on how the age and years ago data are to be interpreted by the program. For example, 'years ago' data (that is Type II data) may be interpreted as completed years, rounded years or projected years because the results of the imputation are affected by the type of interpretation of such data especially when there are a large number of events with such information (see Chidambaram et al 1981). When the input file, the data type and the constraints are specified, DEIR starts the process of date adjustment in three phases. The first phase is the editing phase, the second the imputation and the third the recoding phase.

In the editing stage, the program examines the various forms of the data provided and selects a data type according to the priority set by the user in a sequence and calculates initial (unconstrained) logical ranges. A logical range is the difference between the highest lower limit and the lowest upper limit from a possible set of dates. For example, if an event occurred in 1963, the logical range is from January to December 1963 because the event could have occurred anywhere between these dates. For data type I, the logical range is always equal to 0 because the last month the event has occurred is the same as the first month and the set of possible dates include only one month. It must be noted here that for data type II and IV the logical range is always 11 months. If the logical range is negative, the program notes the error and continues the edit using the first form of data selected.

The second stage involves the application of the interval data if available. This is done on two grounds. First, it is used to define the logical range where the initial logical range is undefined because of lack of information, and second, it is used to improve the initial logical range by checking the interval data for consistency with the data used to calculate the initial logical range. Undefined (events with no information) and negative logical ranges are noted and the program continues using the unadjusted logical ranges. At this stage, the program treats each event independently and adjusts for isolated constraints. If interval data are not available, the program adjusts the initial logical ranges using any available information. It then compares the initial logical ranges (0 months for type I data and 11 months for type II or IV data) for comparability. At this stage, the program treats the entire birth and marriage histories and adjusts for neighbouring constraints and constructs final logical ranges.

Once the adjustment for all constraints is complete and the final logical range is constructed, the program imputes the date with each possible month by selecting a month with equal probability from the final logical ranges or by taking the month corresponding to the midpoint of the final logical range. This is done for all final logical ranges that are positive. Final logical ranges with 0 months are considered as exact dates and no imputation is done. In case a final logical range is negative, or undefined because no information on date of the event is available, this is treated as an error and a not stated value is assigned for that event.

The imputed and exact dates are then converted to a century month code and are written to an output file together with derived date related variables. The events with undefined dates, or with negative logical ranges are also included in the output file with values 9s for these events. The output file is the first part of the WFS Standard Recode file occupying positions from 1 to 510 in a fixed format.

The program also prints details of options used for the run, a list of sample questionnaires from the input file, a list of all questionnaires with errors along with explanatory error messages and three summary tables. The first table shows the source of the date information and the second the distribution of the final logical ranges by type of event. The third table presents the number of errors detected, the number of questionnaires read, the number with at least one error and the number of events with not stated dates in the output file.

DEIR has been applied to impute missing, partial or inconsistent marriage and birth dates in many WFS surveys. Trussell (1987) shows that the substantive conclusion that could be arrived at from the raw data without applying DEIR is not changed due to imputation by DEIR. He also suggests that fertility rates by time period are likely to be far less distorted as a result of the imputation. However, there are some shortcomings of the procedure that are worth mentioning. First, the procedure entertains a large number of marriage and birth dates because the input file to DEIR requires information on ten marriage and 36 birth dates (see WFS, 1984). Not all these data are used in the imputation as the output file contains 8 marriage and 24 birth dates only. Since the program does not handle blanks, all the marriage and birth dates that are not applicable must be filled with not applicable codes (8s). This is time consuming especially when the input file can't be created by a questionnaire specific program like that of the WFS perhaps due to difference in the questionnaire design or content. Second, imputed cases cannot be flagged because there is no facility within the program that allows the flagging of imputed cases. This may prevent other analysts from using their own approach in dealing with missing data and it may also lead them to the wrong conclusion that the data are based on complete responses unless there is a clear indication about the number of imputed cases. Third, as the method does not allow the estimation of the reduction in the bias due to imputation, the efficiency of the estimates of population parameters cannot be evaluated.

In spite of these shortcomings the program is the most convenient and simple method available for handling missing or inconsistent dates in birth histories because it uses the information from the individual record and avoids the use of other records to impute missing dates and does not require the reclassification or stratification of the data into imputation classes. DEIR is applied to the M.O.H. birth history data.

4.5. Imputation of Dates in the M.O.H. Data

4.5.1. The Input File

Although it was possible to use the WFS questionnaire specific program to extract the history information and related data from the raw data file, this was not done. Instead, the input data file to DEIR was created by using the statistical package SPSS-X. First, the background information about the respondent (identification, interview date, birth date, pregnancy status, expected delivery date, breastfeeding information, etc.) were extracted from the raw data file (see the WFS Software User's Guide). Then the birth history was specified. This included month and year of birth, age of mother at time of birth, age of child at interview, interval in months and years from the previous birth, sex, status of the child (living or dead), duration of pregnancy for non-live births and age in months and years of the child born alive but died subsequently for a total of 36 births. Finally, the marriage history information was extracted. This included month and year of beginning of marriage, months and years ago of beginning of marriage, age at beginning of marriage, interval in months since end of previous marriage, status of marriage (that is, married, divorced, widowed or separated), the type of union (common law, church, etc.), month and year of end of marriage, months and years ago of end of marriage, and duration in months and years of marriage for each of ten marriages. Since the M.O.H. survey did not collect information on months and years ago as well as age at event except for respondents age and first marriages, not stated values (9's) were assigned to such variables. Moreover, the birth history was confined to 17 births only and the marriage history was confined to the first marriage. As a result, not applicable values (8's) were assigned to birth history beyond the 17th birth and to the marriage history beyond the first marriage. A total of 639 variables for each case were extracted and values recoded for each variable according to the DEIR requirement. After careful checking of the codes of variables, the data were written to a file with record length of 1,200 as required by the program.

4.5.2. Definition of Data Types and Constraints

As discussed earlier, DEIR can take four data types as well as interval data. However, the data types collected in the survey were limited to Data Types I (month and year) and data type IV (age of respondent at survey and her age at marriage). The dates of birth and marriage of the respondent if reported were given in month and calendar year. The birth history information was collected entirely in the form of calendar month and year or calendar year only and no information was collected on the age of the woman at birth of child, age of child at survey, or months and years ago since the birth of the child. Thus the input data was limited to type I and type IV and this may affect the construction of the improved logical ranges. However, it was assumed that the effect will be negligible.

The constraints were set on the minimum and maximum age of respondent, the minimum age at first marriage and the minimum age at first birth, the earliest and latest dates of interview, how age should be interpreted, and which imputation method (random or midpoint method) to be applied. Minimum and maximum ages were taken as 15 and 50 respectively, and the minimum age at first marriage and first birth were taken as 10 years and 12 years respectively. These were determined from past experience (all past surveys assumed minimum age at marriage as 10 years and births were tabulated starting from age 10 (C.S.O. 1970, 1974, 1984a)). The age data was interpreted as completed years (rounded years was applied but the difference was trivial), the interview date was fixed as March 1986 (as stated earlier although date of interview was collected it was not coded) and it was decided to use random imputation (although midpoint imputation was possible).

The summary of program parameters, source of data type, distribution of final logical ranges and summary of error statistics as generated by DEIR are presented in Table 4.1 through 4.4.

Table 4.1 presents the input data type, the interpretation of the age data, the constraints and the imputation method while Table 4.2 presents the source of the data by type of event, that is, the number of events reported in the form of month and year, age at event, age at interview and those which were not given at all in any form.

Table 4.1 : Forms of Data Used and Priority

priority 1 = calendar date
priority 2 = age of resp at event,age of child at int
interval data is not used
interview dates are 03-86 to 03-86
respondents age is 15 to 49 years
birth min age is 12 yrs,min interval is 07 months
marriage min age is 10 yrs,min int is 00 months
age is interpreted as completed yrs
premarital births are avoided
nonlive births are not used
error cases are not printed
the record file is written
imputation method is random

Table 4.2 : Source of Data.

event	month +year	year only	month +year ago	age at event	age at intr	intr month +year	inter year only	not given	tot.
Resp brth	613	537	0	0	2248	0	0	33	3431
all births	7891	3954	0	0	0	0	0	680	12565
1st births	1816	790	0	0	0	0	0	194	2800
next-last	1654	687	0	0	0	0	0	64	2405
last birth	2162	602	0	0	0	0	0	36	2800
beg all mr	962	179	0	0	1666	0	0	185	2992
end all mr	0	0	0	0	0	0	0	419	419
beg 1st mr	962	179	0	0	1666	0	0	185	2992

Table 4.3 shows the final logical ranges constructed by the program using various data types. It may be observed here that 490 births out of a total of 12,565 births (3.9 per cent) had negative final logical ranges and 3,936 (31.4 per cent) had final logical ranges ranging from 1 month to 11 months while 427 births (3.4 per cent) were assigned final logical ranges greater than 11 months. The remaining 7,672 births (61.3 per cent) had zero final logical ranges. Birth dates with negative final logical ranges were not imputed and were

assigned not stated values in the output file while those with positive logical ranges were imputed. The 7,672 births with zero logical ranges were taken as having exact dates. (Note that although 7,891 birth dates were reported as exact dates, 7,672 were accepted as correct by DEIR.) Thus for 35.5 per cent of the children, month of birth was imputed and for 3.4 per cent year of birth was imputed. It may also be observed from the table that most of the births with negative logical ranges were births excluding the last and next to the last births. Most of the birth and marriage dates of the respondent had positive logical ranges and months were imputed. The proportion of respondents with imputed month of birth was 82.1 per cent and those with imputed month of marriage was 56.8 per cent.

Table 4.3 : Distribution of Final Logical Ranges
(in months)

	event							
logic range	respon brth	all brths	first brth	next to last brth	last brth	beg all marr	end all marr	beg 1stmar
<-5	0	308	43	49	34	0	0	0
-5	0	22	1	4	3	0	0	0
-4	0	34	2	8	3	0	0	0
-3	0	34	4	4	2	0	0	0
-2	0	34	6	4	2	0	0	0
-1	0	58	2	13	6	0	0	0
0	613	7672	1795	1604	2097	1293	0	1293
1	0	146	7	14	3	6	0	6
2	0	122	12	21	71	29	0	29
3	0	64	2	5	3	7	0	7
4	0	24	11	4	0	10	0	10
5	0	287	2	31	0	19	1	19
6-10	0	951	140	153	89	100	1	100
11	2785	2382	574	450	422	364	1	364
11+	33	427	199	41	65	1164	416	1164
TOT	3431	12565	2800	2405	2800	2992	419	2992

These figures are much higher than those for the birth histories. The reason is that most of the information on the birth and marriage dates of the respondents were collected in the form of age at event as a result of which month of occurrence was imputed.

Table 4.4 presents summary of the type of errors and inconsistencies as well as the number of events (births and marriages) for which months were imputed. Note that there were 490 cases with not stated (missing) dates in the output file. These cases were selected from the raw data file and examined and it was discovered that these were merely the results of the transposition of digits. This may have been done by the interviewers in the field and were not discovered by the coders, or by the coders themselves while transferring the data to code sheets. These were corrected manually and DEIR was run again. The result had no events with missing dates. This file was considered as the final file.

Since this file contained the first part of the standard recode file with dates and date related derived variables only, information on socio-economic variables (region, residence, literacy, religion and ethnicity), KAP variables and other variables were extracted from the raw data file and put in another file. A new file was created by matching this file with the standard recode file created by DEIR and a file similar to the WFS standard recode file (though slightly different in content) was created. This data file is used in all subsequent analyses in this thesis.

Table 4.4 : Summary of Error Statistics.

RESPONDENTS DATE OF BIRTH NOT STATED	33
RESPONDENTS AGE > MAXIMUM	0
RESPONDENTS AGE < MINIMUM	0
RESPONDENTS DOB AND AGE INCONSISTEN	0
ERROR IN DATE OF STERILIZATION	0
ERROR IN CURRENT PREGNANCY DATA	0
SOURCE OF DATE OF BIRTH INCONSISTENT	0
DATE OF BIRTH NOT DEFINED	754
DATE OF BIRTH AND INTERVAL DATA INCONSISTENT	0
DATE OF BIRTH > MAXIMUM POSSIBLE	297
BIRTH BEFORE MINIMUM AGE	18
FIRST BIRTH BEFORE MARRIAGE	0
BIRTH NOT CONSISTENT WITH STER/PREG DATA	4
DATE OF BIRTH AND MAXIMUM INTERVAL INCONSISTENT	0
DATE OF BIRTH AND MINIMUM INTERVAL INCONSISTENT	490
SOURCE OF DATE OF MARRIAGE INCONSISTENT	0
DATE OF MARRIAGE NOT DEFINED	614
MARRIAGE DATE AND INTERVAL DATA INCONSISTENT	0
MARRIAGE BEFORE MINIMUM AGE	32
MARRIAGE AFTER FIRST BIRTH	0
MARRIAGE DATE AFTER INTERVIEW	0
MARRIAGE DATE AND MAXIMUM INTERVAL INCONSISTENT	0
MARRIAGE DATE AND MINIMUM INTERVAL INCONSISTENT	0
DATE OF INTERVIEW OUT OF RANGE	0
QUESTIONNAIRES READ	3431
QUESTIONNAIRES WITH ERRORS	1170
NOT STATED DATES IN OUT PUT	490

4.5.3. Effect of Imputation on the Date Related Variables

It would have been desirable to obtain several replications of the dates and compute an average value for each date of event in order to take account of stochastic variations. However, such a procedure was not attempted because it requires a substantial amount of computer time and memory. As a result, we cannot measure the amount of bias introduced in the data because of imputation. Moreover, DEIR does not allow the estimation of the reduction in the standard errors due to imputation. However, we assume that the effect of imputation on the levels and trends of fertility would be small because (i) for each event with imputed date, it is only the month of occurrence that was imputed and (ii) estimates of fertility are made by aggregating births of five year age cohorts and periods before the survey.

In this part, we will try to examine the effect of imputation by DEIR on the univariate and multivariate distributions of some of the date related variables. We first compare the univariate distribution of age, age at first marriage, the number of births, the period-cohort fertility and the birth intervals obtained from the raw and imputed data sets. We then fit a multiple regression line to the most recent five year births as a dependent variable and socio-economic and demographic variables as explanatory variables in order to examine the effect of imputation on the regression coefficients.

The Age Structure.

Table 4.5 presents the percentage distribution of women by five year age groups in the imputed and raw data files as well as the percentage distribution obtained by matching the imputed file with the raw data file. It can be observed from the table that the age structure in the two files is similar. The proportion of women in the 20-24 and 30-34 age groups are lower than the corresponding values in the adjacent age groups. It may also be observed that the proportions in the imputed file are slightly higher than in the raw data file for all age groups except the age group 35-39 and 45-49. In the 35-39 age group, the proportion in the imputed file is lower than the proportion in the raw data file indicating a transfer of some women to other age groups, while in the 45-49 age group, the proportions are the same in the two files.

Table 4.5 : Percentage Distribution of Total Women with Reported, Imputed and Matched Ages by Age Group.

age group	reported	imputed	difference	matched
15-19	16.2	16.6	0.4	15.9
20-24	13.6	13.8	0.2	12.7
25-29	17.5	17.8	0.3	16.1
30-34	15.3	15.5	0.2	13.9
35-39	17.3	17.1	-0.2	15.8
40-44	10.1	10.6	0.5	9.1
45-49	8.6	8.6	0.0	7.6
N.S	1.4	-	-	-
Total	100.0	100.0	0.26	91.1

The mean absolute difference in the proportions is less than 0.3 per cent. The proportion of total women for whom the ages matched was 91.1 per cent. This indicates that only 8.9 per cent of the ages differed by five year age groups. At younger ages, that is under 25 years, the proportion matched was higher (less than 1 percent failed to match). However, as age advanced, fewer and fewer numbers were matched probably due to poor reporting of age by older women in the original file. The mean age at survey was 29.92 years and the standard error was 0.158 years in the raw data file while these values were 30.15 and 0.156 years respectively in the imputed data file. The drop in the standard error was 1.3 per cent. The 25th, 50th and 75th percentile values were respectively 22.0, 30.0 and 37.0 years in both files. The 10th and 90th percentile values were respectively 17 years and 43 years in the raw data file and the corresponding values in the imputed data file were 18 years and 44 years. From these observations, it may be concluded that the effect of imputation by DEIR on the age structure is negligible.

Age at First Marriage

Table 4.6 presents the percentage distribution of the difference between the reported and imputed ages at first marriage for ever married women. From the table it may be inferred that the proportion with the same reported and imputed age at first marriage is 40 per cent. For 31 per cent, the reported age is lower than the imputed age and for 29 per cent, it was higher than the imputed age at first marriage. For 38 per cent of the ever married women, the reported age differed from the imputed age at first marriage by one year; for 9 per cent by two years and for 13 percent it differed by 3 or more years.

Table 4.6 : Percentage Distribution of the Deviation Between Reported and Imputed Ages at First Marriage.

Age	Deviation (reported-imputed) in years						
group	-3	-2	-1	0	1	2	3
15-19	12.0	3.0	6.0	57.0	16.0	3.0	3.0
20-24	13.0	6.0	10.0	45.0	23.0	2.0	1.0
25-29	12.0	6.0	11.0	40.0	28.0	2.0	1.0
30-34	13.0	7.0	11.0	39.0	26.0	2.0	2.0
35-39	11.0	6.0	12.0	36.0	32.0	2.0	1.0
40-45	12.0	7.0	13.0	36.0	28.0	3.0	1.0
45-49	13.0	9.0	15.0	34.0	25.0	2.0	2.0
total	12.0	7.0	12.0	40.0	26.0	2.0	1.0

The distribution by age group shows that the proportion with the same imputed age at first marriage as the reported age declined with advancing age of women. It was 57 per cent for women under 20 years and it steadily declined with age and for the oldest age group (45-49) it was just over 33 per cent. This is perhaps due to the relatively more accurate knowledge of the younger women about their ages at marriage. The table also shows that the reported age was less than the imputed age by 2 or more years for 17 per cent of the ever married women, while it was greater than the imputed age by two or more years for only 3 per cent of the ever married women. This may in part be due to the fact that a substantial number of women reported that they had married when they were under 10 years of age and that during the imputation the minimum age at first marriage was set as 10 years.

In general, the table shows that for most women, the reported and imputed ages at first marriage are the same or differed by only one year (78 per cent) and also the proportion with negative and positive differences is roughly the same except for those women in the 35-39 age group.

The mean age at first marriage for all ever married women was 15.53 and the standard error was 0.068 years in the raw data file, while in the imputed data file these values were 16.23 and 0.048 years respectively. The imputed mean age at first marriage was higher by 0.7 years and the standard error dropped by 29.4 per cent after imputation. The median age at first marriage was 15 years in the raw data file and 16 in the imputed data file. The 10th, 25th, 75th and 90th percentiles were 12, 14 and 17 years in both files.

When duration since first marriage was considered, the mean duration was 15.94 years and the standard error was 0.168 years in the raw data and in the imputed data, the mean was 15.21 and the standard error was 0.159. The difference in the mean duration before and after imputation was about 0.7 years (the same as that in the mean age at first marriage). The median duration is the same in the two data sets (15.0 years) while the 10th, 25th, 75th and 90th percentiles differed by only 1.0 year.

Here again, it may be stated that imputation has not seriously affected the age at first marriage and the duration at marriage. Although age at first marriage differed by two or more years for about 22 per cent of the ever married women and mean age at first marriage differed by about 0.7 years between the raw and imputed files, these differences are not entirely due to imputation. We have stated earlier (see Chapter Three) that a substantial proportion of the ever married women reported that they got married while under ten years of age but during imputation, the minimum age was set at 10 years. It appears that this has caused most of the differences rather than imputation. However, it is worth pointing out the substantial gain in the sample size that has been achieved after imputation of dates. The number of ever married women in the sample increased from 2,346 to 2,992 ever married women - an increase of 27.5 per cent. As noted earlier, this is mainly due to the recording of age at marriage only as a result of which month of marriage was imputed by DEIR.

Total Children Ever Born, Annual Births and Period-cohort Fertility

While the number of women by parity obtained from questions on children ever born and children surviving agreed perfectly in the raw and imputed data files, the distribution obtained by counting the birth entries indicate minor discrepancies. The percentage distribution of women by parity obtained from the birth history of the raw and the imputed data are presented in Table 4.7. A comparison of the two distributions shows that there is a drop in the number of lower parity (0 to 3) women and a rise in higher parity (4 and more) women after imputation. A drop of 1.3 per cent, 0.6 per cent, 0.9 per cent and 1.1 per cent occurred in the 0, 1, 2 and 3 parity women respectively and an increase ranging from 0.1 to 0.8 per cent in the number of women with 4 or more children. The increase is larger for women with 6, 7 and 8 children (0.6 to 0.8 per cent). These differences in the two files are mainly due to missing dates of birth in the raw data file. As the distribution of women by parity was obtained by counting the entries in the birth history with defined dates of birth, those births with missing dates were omitted in the raw data file and women with one or more missing dates of birth were considered as having two or more births lower than what they actually had. As imputation recovered the omitted births, women belonged to their actual parity group and the result was higher proportion of women with parity four or more.

Table 4.7 : Percentage Distribution of Women by Parity.

parity	raw data	imputed data	difference
0	19.5	18.2	-1.3
1	12.2	11.6	-0.6
2	12.0	11.1	-0.9
3	12.8	11.7	-1.1
4	11.3	11.7	0.4
5	9.1	9.2	0.1
6	7.1	7.8	0.7
7	5.4	6.2	0.8
8	4.2	4.8	0.6
9	2.7	3.4	0.7
10	2.2	2.4	0.2
11	1.1	1.3	0.2
12	0.3	0.3	0.0

A study conducted by Pullum et al (1984) in 6 WFS surveys also show net transfer of women from lower parities to higher parities after imputation. However, the transfer was mostly confined to parity two from parity 0. For instance, in Ghana, the number of women with 0 parity dropped by 2.4 per cent and the number with two parities increased by 1.2 per cent while in Haiti, the drop in the zero parity was 1.7 per cent and the gain in the two parity group was 1.2 per cent (Pullum, et al, 1984).

When the distribution of births that had occurred during the last 25 years prior to the survey by single year are considered, a substantial difference becomes apparent in the raw and imputed data files. Figure 4.1 presents the yearly births for the last 25 years before the survey obtained from the raw and imputed data files. The graph shows that in most cases, the number of births is higher in the imputed data file. It may also be seen from the graph that for the most recent period (0 to 4 years prior to the survey), the annual births in the two files do not agree indicating that dates of birth were omitted or inconsistent even for the recent period. The difference in the annual number of births gets wider as the period increases further into the past. Part of these differences are due to missing dates and the other part may be due to the imputation procedure. As pointed out earlier, DEIR imputes dates randomly within the final logical range and some of the birth dates with longer than 11 months logical range may be allocated to a different year than the year in which they actually occurred. When annual births were grouped into five year periods before the survey, the percentage difference in the number of annual births obtained by subtracting the number in the raw data from the number in the imputed data and dividing the difference by the number in the imputed data, the difference appear to be slightly reduced. For the recent five year period, the difference is slightly higher but falls for the next five year period and then increases with period (see Table 4.8).

Table 4.8 : Percentage Difference in Annual Births in the Raw and Imputed Data Files by Five Year Periods Before the Survey.

Period before survey	per cent difference
0-4	4.91
5-9	3.96
10-14	5.16
15-19	11.87
20-24	13.30
25 +	6.70

Both and Table 4.8 show that contrary to expectations, even for the recent 5 year period, some of the birth dates were omitted, partially reported or were not reported to a reasonable degree of accuracy and a substantial amount of the dates were imputed. This is apparent from the period-cohort specific fertility rates computed using FERTRATE - the standard WFS software for this purpose. These rates and the cumulative period and cohort rates are presented in Table 4.9 and panels A, B and C in five year periods before the survey by cohort. Ratios of the cumulative period and cohort rates from the imputed file to those from the raw data file from Table 3.15 (chapter Three) are presented in Table 4.10 Panels A and B. It may be observed from these tables that the rates from the raw data under-estimate the true levels of fertility. Both the cumulative cohort rates (Ps) and within period rates (Fs) from the raw data are lower than those from the imputed data. This is mainly due to missing or impossible birth dates in the raw data file. When FERTRATE encounters missing or impossible birth dates, it drops the births leading to a deficit in the numerator only whereas if it encounters missing or impossible birth or marriage dates (in the case of marital fertility rates) of the respondent, it drops the woman together with all her births. In this case, a deficit arises in both the numerator and denominator and the estimates of fertility may not be seriously affected. Since some of the dates of birth of children were missing or inconsistent in the raw data file, perhaps a substantial number of the births were dropped while computing the rates and this had resulted in a lower period and cohort specific as well as cumulative period and cohort rates. However, from the ratios presented in Table 4.10 panels A and B, it may be seen that the rates do not differ substantially for the most recent period prior to the survey. The ratios for the most recent five year period are very close to unity but increase with period indicating that the birth dates for the recent period are relatively better reported compared to those in the remote past. The table also shows that the F ratios are closer to unity than the P ratios. One important aspect that may be noted from these tables is that the pattern of fertility is identical in both the raw and imputed data files. There is an obvious increasing trend in fertility from the remote past up to five to ten years before the survey followed by a decline in the most recent period.

Table 4.9 : Period-cohort Rates, Cumulative Period and Cohort Fertility : Imputed data

	Period before the survey					
	0-4	5-9	10-14	15-19	20-24	25-29
A.	cohort-period fertility rates					
15-19	0.127	0.171	0.160	0.147	0.134	0.132
20-24	0.251	0.256	0.229	0.173	0.170	
25-29	0.292	0.309	0.295	0.239	0.189	
30-34	0.275	0.325	0.305	0.257		
35-39	0.256	0.297	0.270			
40-44	0.188	0.247				
45-49	0.103					
B.	cumulative fertility at end of period (P)					
15-19	0.294	0.444	0.401	0.330	0.283	0.275
20-24	1.699	1.681	1.475	1.148	1.125	
25-29	3.141	3.021	2.623	2.320	1.890	
30-34	4.395	4.248	3.845	3.184		
35-39	5.528	5.330	4.534			
40-44	6.275	5.769				
45-49	6.284					
C.	cumulative fertility within period (F)					
15-19	0.294	0.444	0.401	0.330	0.283	0.269
20-24	1.549	1.724	1.546	1.195	1.133	0.960
25-29	3.009	3.269	3.021	2.390	2.078	
30-34	4.384	4.894	4.546	3.675		
35-39	5.664	6.379	5.896			
40-44	6.609	7.614				
45-49	7.124					

Table 4.10 : Ratios of the Rates (imputed to raw data).

a. ratios of P value

age	period before the survey					
group of cohort	0-4	5-9	10-14	5-19	20-24	25-29
20-24	0.97	1.02	1.10	1.24	1.28	1.25
25-29	1.02	1.08	1.15	1.21	1.18	
30-34	1.08	1.11	1.13	1.16		
35-39	1.09	1.11	1.08			
40-44	1.09	1.08				
45-49	1.07					

b. Ratios of F values

	period before the survey					
Age Group	0-4	5-9	10-14	15-19	20-24	25-29
20-24	1.00	1.02	1.03	1.13	1.19	1.19
25-29	1.00	1.04	1.06	1.14	1.16	
30-34	1.02	1.04	1.05	1.13		
35-39	1.03	1.05	1.02			
40-44	1.03	1.04				
45-49	1.03					

Birth Intervals

Comparison of the birth intervals in the imputed and raw data files shows that the negative second and subsequent birth intervals that were present in the raw data file have been adjusted in the imputed data file and that a minimum birth interval of 0 months (for multiple births) was obtained for the second and subsequent births. As a result of random imputation applied in using DEIR, the substantial heaping on multiples of six months that was present in the raw data was also reduced in the imputed data as can be seen from figure 4.2(a) through 4.2(d).

The percentile values for the first eight birth intervals presented in Table 4.11 show that the values do not differ much in the raw and imputed data sets. Large differences occurred in the median and 75th percentile values for the first birth interval only. (These values were higher in the raw data file than in the imputed data file by five months.) The 10th percentile, the median and the 75th percentile values for the second birth interval differed by two months while the

90th percentile differed by four months. Most of the third and higher birth intervals are the same for the raw and imputed data sets or differed by only one or two months as can be seen from Table 4.11.

Table 4.11 : Percentile Values of Birth Intervals by Birth Order.

birth order	percentiles											
	raw data						imputed data					
	10	25	50	75	90	mean	10	25	50	75	90	mean
1	-5	15	36	72	72	38.96	-3	13	31	67	72	33.15
2	11	20	26	38	57	31.83	13	20	28	40	61	33.11
3	12	20	26	37	54	30.87	12	18	26	37	53	29.99
4	12	18	25	36	54	30.05	12	18	26	36	53	29.59
5	12	18	24	36	51	29.47	12	18	25	36	52	29.21
6	12	16	24	36	48	28.35	12	17	25	36	50	28.51
7	12	16	24	36	49	28.68	12	17	25	36	50	28.66
8	12	16	24	36	49	28.14	12	17	24	34	48	27.69

The mean birth intervals also presented in Table 4.11 show that the difference is not substantial in the two files except for the first and second birth interval. The mean interval length for the first interval was about half a year lower in the imputed file while the second mean interval was higher by a little over 1 month and the difference in the third birth interval was a little less than one month. For the fourth and higher births, the mean birth intervals differed by less than half a month.

The standard error of the mean birth intervals for the raw data are 0.559, 0.408, 0.418, 0.474, 0.515, 0.580, 0.681 and 0.857 months for the first, second, third, fourth, fifth, sixth, seventh and eighth birth intervals respectively. For the imputed file, the corresponding values were 0.525, 0.404, 0.395, 0.442, 0.484, 0.549, 0.642 and 0.806 for the first to eighth birth intervals respectively.

As expected, the standard errors of the mean birth intervals are lower in the imputed file mainly due to the addition in the sample size. However, the percentage differences do not exceed 7 per cent for each of the eight birth intervals.

Hence, we may conclude that the birth intervals have not changed substantially because of imputation. But here again, it may be noted that the number of cases for which the birth intervals were computed increased substantially after imputation. The increase was 16.9 per cent for the first birth interval, 10.0 per cent for the second, 9.1 per cent for the third, 8.7 per cent for the fourth, 8.9 per cent for the fifth, 7.7 per cent for the sixth, 4.1 per cent for the seventh and 3.4 per cent for the eighth birth intervals.

4.5.4. Effect of Imputation on the Coefficients of a Multiple Regression Equation

A multiple regression line was fitted to the most recent five year fertility obtained from the imputed and raw data sets separately. The number of children born during the preceding five years before the survey (V225) was taken as the dependent variable and the age at first marriage (AGMAR), age at first birth (AG1), the duration of marriage (MRDUR) and four dummy variables - religion (RELG, 1 if christian and 0 if muslim), residence (RESID, 1 if urban and 0 if rural), literacy (LIT, 1 if literate and 0 otherwise), and ethnicity (ETHN, 1 if Amhara and 0 if Oromo) were used as explanatory variables. Note that other religious and ethnic groups were not included in this analysis. The objective here is not to fit an appropriate model to describe the relationship between the most recent period fertility and the demographic and socio-economic variables but to show how the relationship between these variables is affected by imputing missing, incomplete or inconsistent dates and whether imputation in this particular case would lead to a different conclusion than would have been arrived at without the imputation of the missing and inconsistent dates.

The results of the analysis show that the increase in multiple R was very small (0.373 to 0.389) and R squared adjusted for degrees of freedom increased by 1.3 per cent (from 13.5 % to 14.8 %). The regression was significant for both data sets. The number of cases increased from 1,268 in the raw data file to 1,976 in the imputed data file. The correlation matrix, the regression coefficients, their standard errors and other relevant statistics are presented in Table 4.12 and 4.13 for the raw data and imputed data sets respectively. By comparison of the correlation matrix, it becomes evident that the correlation coefficients between the dependent and each of the explanatory variables have changed substantially after the imputation of missing, incomplete or inconsistent dates. For instance, for some of the variables (ETHN, RELG and RESIDE), the correlation coefficients increased while for others (LIT, AGMAR, AG1 and MARDUR), it decreased. It may also be observed from the table that the correlations between most of the explanatory variables have also changed. ETHN and RELG, and ETHN and RESIDE showed no change in the correlations between them before and after imputation. The correlation between ETHN and AGMAR, ETHN and AG1, RELG and AGMAR, RELG and AG1, RELG and MARDUR, RESIDE and MARDUR, LIT and AG1, LIT and AGMAR, and AGMAR and AG1 decreased and became statistically insignificant after the dates were imputed. On the other hand, the correlations between LIT and ETHN, ETHN and MARDUR, RELG and LIT, RESIDE and LIT, AGMAR and MARDUR, and AG1 and MARDUR increased after imputation. However, except the correlation between RESIDE and LIT, RELG and RESIDE, ETHN and RELG, ETHN and RESIDE, AGMAR and MARDUR, and AG1 and MARDUR, all other correlations were not statistically significant ($P > .05$). The regression coefficients also indicated similar patterns. For some of the variables, the coefficients increased and became statistically significant and for others, they decreased and became insignificant after imputation. AGMAR, and LIT were not significantly related to recent births in both the raw and imputed files. This may be expected as the level of literacy in the population is low (less than 25 % of women 15-49 were literate) and most women marry early. However, the coefficient for LIT changed in sign and also increased in absolute terms. ETHN and RELG which appeared to have no significant effect on recent births in the raw data indicated a significant effect after the dates were imputed. The standard errors of the coefficients also changed as expected.

Table 4.12. Correlation Matrix for the Raw Data

Correlation:

	V225	ETHN	RELG	RESIDE	LIT	AGMAR	AG1	MRDUR
V225	1.000	-.149	-.062	-.056	-.079	.105	.076	-.185
ETHN		1.000	.326	.328	.097	-.262	-.234	.093
RELG			1.000	.209	.097	-.169	-.120	.046
RESIDE				1.000	.195	-.183	-.118	.087
LIT					1.000	-.045	-.102	-.109
AGMAR						1.000	.603	-.223
AG1							1.000	.218
MRDUR								1.000

Multiple R	.37315
R square	.13924
Adjusted R square	.13473
Standard error	.89728

------------- Variables in the Equation ------------------

Variable	B	SE B	Beta	T	Sig T
MRDUR	-.038058	.003274	-.348862	-11.624	.0000
RELG	-.099261	.072220	-.036776	-1.374	.1695
LIT	.009424	.089989	.002858	.105	.9166
AG1	.026426	.005818	.167193	4.542	.0000
ETHN	-.075017	.055661	-.038311	-1.348	.1780
RESIDE	-.247814	.058693	-.119928	-4.222	.0000
AGMAR	-.011837	.006716	-.065373	-1.763	.0782
(Constant)	1.684785	.148682		11.331	.0000

The standard errors for LIT and RELG decreased by over 15 per cent (17 % for RELG and 37 % for LIT) while for others, the reduction was about 10 per cent. This is mainly due to the increase in the number of cases included in the imputed file.

In general, the analysis shows that although births in the recent five years before the survey appear to be weakly related to the background socio-economic and demographic variables in both the raw and imputed data sets, the changes in the various estimates suggests that estimates based on the raw data would be less efficient because of smaller cases included. In addition, existing socio-economic and demographic differentials could be hidden for some of the variables and for others, it could be exaggerated if the analysis was limited to the raw data file.

Table 4.13. Correlation Matrix for the Imputed Data.

Correlation:

	V225	ETHN	RELG	RESIDE	LIT	AGMAR	AG1	MRDUR
V225	1.000	-.162	-.192	-.187	-.158	-.187	-.161	-.176
ETHN		1.000	.326	.327	.116	-.067	-.070	.082
RELG			1.000	.208	.153	.055	.042	.033
RESIDE				1.000	.303	-.060	-.061	.018
LIT					1.000	.008	-.050	-.127
AGMAR						1.000	.747	.251
AG1							1.000	.256
MRDUR								1.000

Multiple R	.38881
R square	.15117
Adjusted R square	.14794
Standard error	.93536

------------------ Variables in the Equation -------------

Variable	B	SE B	Beta	T	Sig T
MRDUR	-.042610	.002917	-.353505	-14.606	.0000
RELG	-.189896	.059814	-.072812	-3.175	.0015
LIT	-.053816	.056639	-.022665	-.950	.3422
AG1	.033258	.005204	.157980	6.391	.0000
ETHN	-.170485	.048802	-.082832	-3.493	.0005
AGMAR	-.012269	.009445	-.032290	-1.299	.1941
(Constant)	1.79068	.109302		18.210	.0000

To sum up, the coefficients of the regression equation are close to zero and the multiple R as well as the correlations between the dependent and explanatory variables indicate weak relationships in both data sets. There does not appear to be a substantial difference in the strength and direction of the relationship between the dependent and independent variables as well as within the independent variables themselves in the two data files. However, the changes in the magnitude and sign of some of the coefficients may lead an analyst to a slightly different conclusion if the raw data file were used instead of the imputed data file.

4.6. Summary and Conclusion

In this chapter, we have reviewed the sources, problems and solutions of nonresponse in surveys in general and presented a brief discussion of the application of DEIR - the WFS software for editing, imputing and recoding dates to our data. We have also discussed the extent of imputation of dates by comparing the date related variables from the raw and imputed data sets.

The results suggest that the effect of imputation was marginal on the age structure, the age at first marriage and the duration of marriage. However, the dates of birth of children have changed to some extent. The birth intervals were affected by the imputation as the negative values of the second and subsequent intervals have been adjusted and the heaping on multiples of six months was reduced during the imputation. The period and cohort fertility estimates were slightly lower in the raw data file. However, the general trend of fertility has not changed. The sample size has increased substantially after the application of DEIR. The coefficients of a regression equation fitted to the most recent period fertility also indicated some minor changes.

In general, there is an improvement in the data and the values of variables are consistent after imputation than they were before. However, it is worth pointing out that a substantial amount of computer time and memory has been used to achieve this consistency and that there is no guarantee that the imputed values mimic the true values. The best solution is therefore, to minimize the amount of nonresponse and attempt to collect relatively accurate information. This depends on the development and application of the survey instruments. The difficulty of correcting and imputing missing and inaccurate data can be reduced by giving intensive training to interviewers, proper supervision and checking of the field work, and taking care in the field and office editing of the data. This, we hope will reduce the cost of machine editing and imputing as well as reduce the delay in analysing the data and preparing the report. Therefore, it may be recommended that in future surveys in the country, the focus should be to collect better quality data by using well trained field and office staff rather than imputing and adjusting poor data.

Figure 4.1 : Percentage Distribution of births by calendar year of birth (raw data and imputed data).

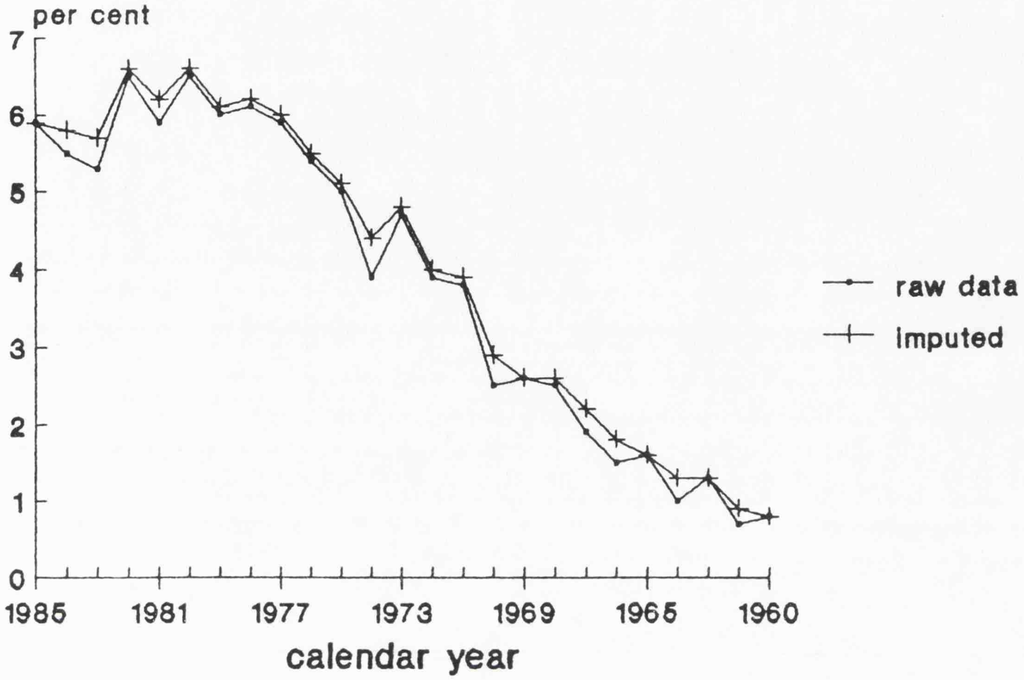
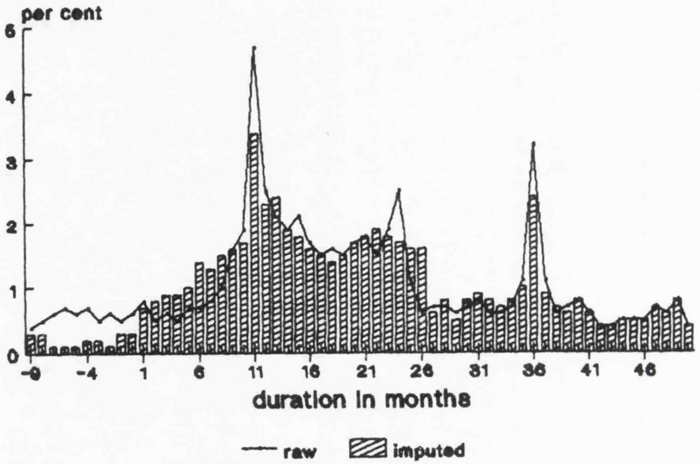
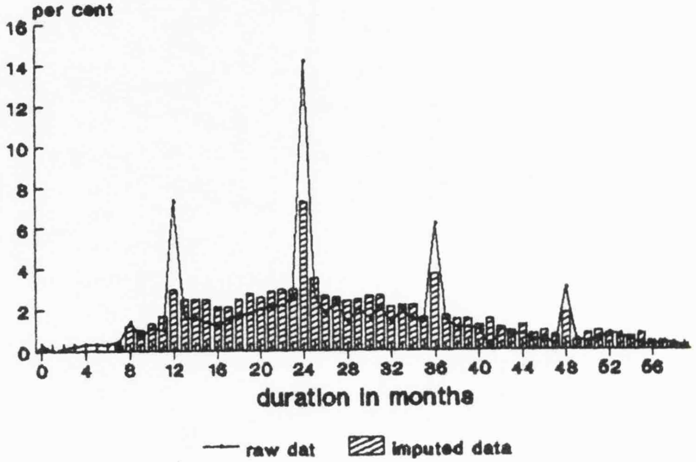


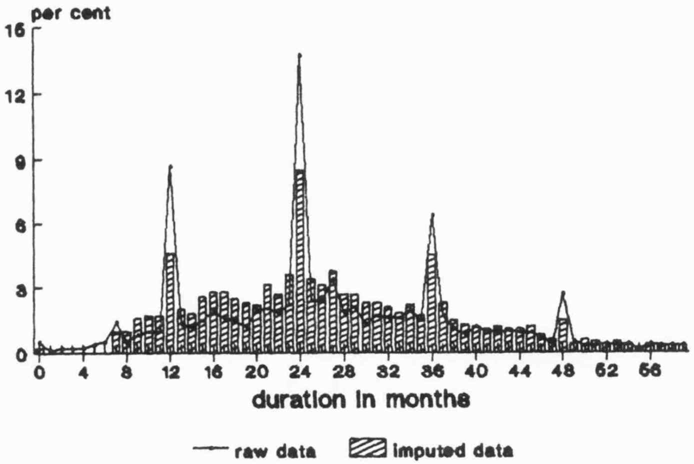
Figure 4.1a : First birth intervals before and after imputation.



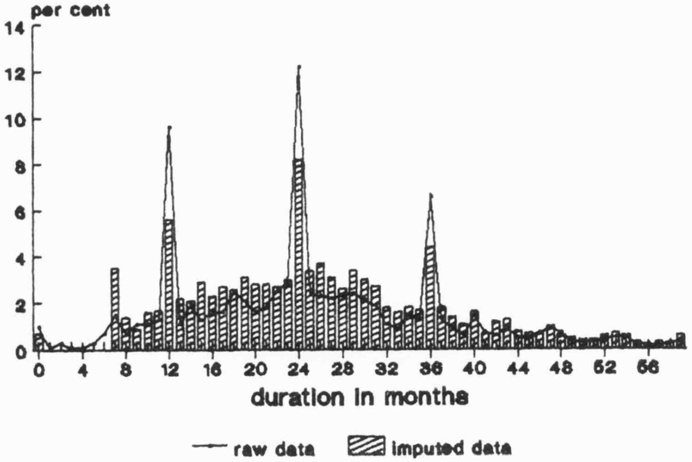
b. Second birth intervals



c. third birth intervals



d. fourth birth intervals



CHAPTER V

LEVELS AND TRENDS OF FERTILITY

5.1. Introduction

Although reliable information on the reproductive behaviour of Ethiopian women has been scarce, the general impression has been that the society is one of the pro-natalist societies in Sub-Saharan Africa where the average number of births per woman has been and remains high. The M.O.H. Survey allows the validation or otherwise of this loose statement and also the quantification of the rather vague expression 'high fertility'.

This chapter attempts to provide information on the levels and past trends of fertility in Central Ethiopia. It is essentially an investigation of the levels and trends of fertility behaviour as revealed by the reported birth rates by period of occurrence and by mothers' age, marriage and motherhood duration. It is expected to depict the essential features of the reproductive behaviour of women in a society which is believed to be in a pre-transition state. Data on children ever born and births in the last 12 months preceding the survey obtained from the 1970 and 1981 surveys in addition to the M.O.H. birth history data will be used in the analysis.

The chapter is organized in seven sections. The following section provides a brief discussion of the method of analysis applied to the data. Section three presents the current levels of fertility while section four examines the recent trends (i.e., for the last 15 years or so). Section five provides the socio-economic and demographic explanation for the continued prevalence of high fertility in the population and section six discusses the causes for the observed recent trends. Section seven concludes the chapter with a short summary of the results presented earlier.

5.2. Methodology

Total absence or incompleteness of birth registration and problems associated with defective data obtained from censuses and surveys in developing countries led to the development of indirect techniques of fertility estimation.

The P/F ratio method developed by Brass (1964, 1968) and subsequently modified by others (UN, 1983) is commonly used as a powerful indirect technique for estimating recent fertility from defective data in developing countries. Available estimates of fertility in Ethiopia were also based on this technique (Mengistu, 1989; Berhanu, 1985a, C.S.O., 1984a).

The Brass P/F ratio procedure assumes that: (i) fertility has been approximately constant for the last 15 years or so before the survey, (ii) errors in the data are uniformly distributed and that the average error in the reference period is independent of the age of women, (iii) the fertility experience of surviving women is not different from those who fail to survive, and, (iv) a model age specific fertility schedule that corresponds to the age pattern of fertility in the population is available (Brass, 1975). Detailed discussion of the Brass P/F ratio procedure may be obtained from the original sources cited above. However, the essence of the procedure is the adjustment of the age pattern of fertility derived from information on recent births by the level of fertility implied by the average parities of women in age groups 20-24 and 25-29.

Brass (1974) also suggested that the Gompertz relational model would be useful for fertility analysis and later elaborated the idea further by indicating the application of the method (Brass, 1977). Booth (1979) made the basic scale transformations, examined the goodness of fit of the model to real data and considered the problems of estimating the parameters. Zaba (1981) made an important contribution by providing methods of separating the examination of fertility pattern from the estimation of levels (see Zaba, 1981 for details).

The model is given by the expression :

$$F(x) = T.\exp[-\exp[-(A+BY_s(x))]]$$

where $F(x)$ is cumulative fertility up to age x, T is the total fertility (TFR), $Ys(x) = -\ln(-\ln F_s(x))$, $F_s(x)$ is the standard cumulated fertility distribution determined by comparing the observed fertility distribution with a set of high fertility schedules produced from the Coale-Trussell fertility model. **A** and B are parameters that influence the location and spread of the fertility distribution. As **A** becomes more negative, childbearing moves towards later years and as B becomes larger, the spread of the fertility distribution becomes narrower (Brass, 1981). The Gompertz transformation applied to the above expression gives:

$$-\ln(-\ln(F(x)/T)) = A+BY_s(x).$$

Once **A** and **B** are obtained, **T** can be estimated as

$$T = F(x).\exp[\exp[-(A + BY_s(x))]].$$

Information from mean parities or a combination of mean parities and current fertility can also be used in the model (see Zaba, 1981). The Gompertz relational model is an improvement over the Brass P/F ratio procedure because it relaxes the assumption of constant fertility in the recent past.

Recently, the availability of detailed maternity history data called for more refined techniques of estimating fertility levels and trends. One approach is the computation of birth intervals and parity progression ratios using life table techniques for different cohorts and periods before the survey (Smith, 1980; Srinivasan, 1980; Rodriguiez and Hobcraft, 1980; Hobcraft and McDonald, 1984). The other line of investigation is the calculation of fertility rates for different subgroups of the sample classified by period of occurrence, age of the mother at birth of the child and age cohort of the mother. This approach is a simplified version of the conventional P/F ratio procedure and is widely used in birth history analysis (Hobcraft et al, 1982). Measures of fertility are obtained by taking the number of live births during a given period born to women of a given age (or age group) as numerator and the number of person years lived by that age (or age group) during the period as denominator.

Unlike the conventional P/F ratio methods, the P/F ratio method for birth histories does not assume constant fertility in the recent past. In addition, it does not require a model age specific fertility schedule to adjust the reported age specific rates and provides direct estimates of the levels and trends of fertility. Moreover, by providing measures of fertility by duration of marriage or motherhood in addition to age, it makes maximum use of the birth history data and also allows the separation of the effect of changes in the age at first marriage or first birth from changes in marital or maternal fertility and thus considerably improves the interpretation of fertility trends.

Since the data from the various surveys used in the analyses might have been affected by errors of omission and the wrong perception of the reference period, it was thought useful to apply the P/F ratio method, the Gompertz relational model and the period-cohort analysis in order to see if estimates are consistent. The Brass P/F ratio procedure and the Gompertz relational model were applied to the mean number of children ever born and the age specific fertility rates for each of the three years, 1970, 1981 and 1986 and the period-cohort analysis was applied to the birth history data.

The period-cohort measures of fertility presented in this chapter were obtained using the program FERTRATE (WFS, 1984). Since estimated single year period rates may have high standard errors relative to the measures themselves, in the investigation of recent trends, for presentation, the measures were aggregated over five year age or duration and period groups.

5.3. Current Fertility

5.3.1. Age Specific Fertility

Age specific fertility rates, that is the number of births per woman year, which includes both never married and ever married women by five year age groups computed from births during the year before the survey are presented in Table 5.1 below. The rates increase with age starting from 132 births per 1000 women aged 15-19, reach a peak value of 287 births per 1000 women aged 25-29 and then gradually decline to a value of 77 births per 1000 women aged 45-49. Each of the middle four age groups (i.e., 20-24, 25-29, 30-34 and 35-39) contributed on the average 18.6 per cent of the total fertility rate. When these age groups are taken together, they contributed nearly 75 per cent of the total fertility rate while women in their 40s contributed about 17 per cent of the total fertility. This shows that the population is characterised with a high fertility rates over a broad age range. Similar patterns with peak fertility occurring at 25-29 age group have been obtained in most of the Sub-Saharan African countries that participated in the World Fertility Survey (Cochrane and Farid, 1989).

Table 5.1: Age Specific Fertility Rates per Woman.

Age group	N	ASFR	Cumulative Fertility
15-19	568	.132	0.660
20-24	475	.264	1.980
25-29	609	.287	3.415
30-34	533	.265	4.740
35-39	586	.254	6.010
40-44	363	.163	6.830
45-49	297	.077	7.210

Total fertility rate is 7.21 and the gross reproduction rate (GRR - the average number of daughters that would be born to a woman during her life time if she passed through the childbearing ages experiencing the average age specific fertility) computed from these rates by assuming a sex ratio of 1.05 at birth is 3.52 children per woman. The net reproduction rate (NRR - the average number of daughters that would be born per woman throughout her childbearing age span under given age specific fertility and mortality schedule) was 2.66 - a value more than two and half times the replacement level fertility under the prevailing level of mortality. (NRR was computed using the formula $NRR=l_m xGRR$ where l_m is the probability of surviving up to the mean age of childbearing. l_m was computed from Blacker (1986), Table 4.8).

However, it is worth pointing out that the age specific fertility rates presented in Table 5.1 are lower than those presented in Table 3.7 (page 41) in Blacker (1986). For each age group, the rates in Table 5.1 are lower than those in Blacker by about 10.7 per cent on average and consequently, the total fertility is lower by nearly one child per woman (7.21 against 8.08). This inconsistency between the two results is mainly due to imputation. Unlike those of Blacker, the rates in Table 5.1 were obtained from the imputed data file where the missing, incomplete or inconsistent dates of events were adjusted. It was shown earlier (see Chapter Four) that even for the most recent period, a substantial number of the births had omitted, partially reported or inconsistent dates and that these were imputed by DEIR. Although it is not clear how such cases were handled in Blacker (1986), it appears that cases with missing, incomplete or inconsistent dates of birth (i.e., women's own date of birth or that of their children) might have been omitted from the analysis and this might have slightly inflated the rates.

5.3.2. Age Specific Marital Fertility.

Table 5.3 presents the age specific marital fertility rates for the year prior to the survey together with the cumulated marital fertility. Unlike the rates for all women, the age specific marital fertility attain the highest value at the 20-24 age group. The proportion of total marital fertility rate (TMFR) made by each of the following four age groups, 20-24, 25-29, 30-34 and 35-39 is slightly lower than the corresponding values for all women (about 17.5 per cent in this case). The four age groups taken together contributed nearly 70 per cent of the TMFR while the last two age groups (i.e., 40-44 and 45-49) contributed 16.6 per cent of the TMFR. The TMFR obtained from these rates is about 8.8 children per woman.

Table 5.2 : Age Specific Marital Fertility Rates per Women.

Age Group	N	ASMFR	Cumulated Rates
15-19	165	0.239	1.195
20-24	357	0.334	2.865
25-29	518	0.319	4.460
30-34	453	0.295	5.935
35-39	526	0.281	7.340
40-44	292	0.195	8.315
45-49	225	0.096	8.795

As there is no evidence of deliberate parity specific fertility control used by the population, the fertility schedule presented here may be considered natural. However, when the age specific marital fertility rates are compared with those of Coale-Trussell natural fertility model, there appears to be a slight difference especially for women under 20 years and those 40 and over. The rates reported here are higher than the expected rates for women in these age groups. For instance, the rate for women aged 40-44 is 40 per cent higher than the rate in the model schedule and for those aged 45-49, it is more than two and half times higher than the corresponding values in the model schedule.

These differences are perhaps due to errors of dating, that is, older women reporting births that occurred more than a year ago before the survey as occurring within the year preceding the survey, or due to age misreporting. It could also be due to real difference in the pattern of childbearing in this population and in the populations from which the Coale-Trussell models were obtained. Recent studies suggest that variations in the pattern as well as level of natural fertility exist in non-contracepting populations. Tan (1982) points out that populations in different cultural and physical environments exhibit significantly different levels and patterns of fertility even in the absence of birth control. Populations in Sub-Saharan Africa show distinctly different levels and age patterns of marital fertility than the Coale-Trussell model (Robinson, 1987). Robinson (1987) also suggests that the Coale-Trussell model schedule is not the best for describing the pattern of fertility for the developing countries and he provides the average of 33 non-contracepting Asian, Latin American, Middle Eastern and North African populations as a bench mark natural fertility schedule for developing countries. Indices computed by taking the ratios of the age specific marital fertility rates to the rate at age group 20-24 are presented in Table 5.3 together with corresponding indices for the Coale-Trussell's and Robinson's natural fertility schedule. The table also presents the ratios of the indices obtained from the rates for Arsi and Shoa to those of the model schedules. Knodel (1977) suggests that for populations experiencing natural fertility, ratios of the index values should remain close to unity at all ages and for those with controlled fertility, they should fall progressively below unity with increasing age. The ratios in Table 5.3, columns (5) are closer to unity at younger ages (i.e., 20-24 to 30-34) and thereafter increase progressively with age. This is also true for 1970 and 1981 survey data and could be representing a typical fertility pattern. The fact that these ratios lie above unity at all ages further supports the argument that the population is a natural fertility population. Note that the age pattern of fertility in the population appears to agree rather better with the Coale-Trussell than with Robinson's model schedule.

Table 5.3 : Age Specific Marital Fertility Relative to that of the 20-24 Age Groups.

age group (1)	Arsi &Shoa (2)	Coale-Trussell (3)	Robinson (4)	2/3) (5)	(2/4) (6)
15-19	0.716	0.545	0.412	1.314	1.738
20-24	1.000	1.000	1.000	1.000	1.000
25-29	0.955	0.913	1.080	1.046	0.884
30-34	0.883	0.813	0.902	1.086	0.979
35-39	0.859	0.738	0.686	1.164	1.252
40-44	0.584	0.404	0.328	1.446	1.780
45-49	0.269	0.111	0.115	2.423	2.339

5.3.3. Mean Number of Children Ever Born.

The mean number of children ever born is one of the most frequently used measure in fertility analysis. It is simply the number of children ever born per woman and is sometimes referred to as current parity. It is an indicator of the quantum of fertility of a population. For instance, the mean number of children ever born to women aged 45-49 years provides an estimate of the cumulative fertility by the end of the reproductive period.

Table 5.4 presents the mean number of children ever born to all women and to ever married women by age at survey. As expected, the means increase consistently with increasing age. For all women, it starts at a value of 0.29 children per woman aged 15-19 and reach a value of 6.6 children per woman aged 45-49. For ever married women also, the means increased consistently with advancing age starting from 0.74 children per ever married woman aged 15-19 and reach 6.6 children for those aged 45-49. Note that the mean number of children ever born is about the same for the two groups of women in the older age groups (i.e., 30 and over) but for younger women, however, there is a substantial difference. This is because of the large proportion of single women among the younger women. For instance, about 55 per cent of the women aged 15-19 and about 10 per cent in the 20-24 age group were single at the time of the survey.

Table 5.4 : Mean Number of Children Ever Born.

age group	all women	ever married women
15-19	0.29	0.74
20-24	1.75	1.96
25-29	3.14	3.22
30-34	4.39	4.41
35-39	5.49	5.50
40-44	6.00	6.02
45-49	6.55	6.56

When the values in Table 5.4 for all women are compared with those of Blacker (1986) (Table 3.1, page 31), there are minor differences in the means. As mentioned earlier, these differences are due to the adjustment of the missing, incomplete or inconsistent dates in the birth history. Unlike those of Blacker, the values presented in Table 5.4 were generated by counting the entries in the birth history of the imputed file.

Although mean number of children ever born is an indicator of the quantum of fertility in a population, it does not reflect the family building pattern of a population. Parity progression ratio (PPR), that is the proportion of women with at least n children who go on to have at least one more, is a particularly sensitive indicator of the family building pattern of a population (Wilson, 1985). Parity progression ratios reflect the sequential nature of family building, that is, women (or couples) are able to have a second child only if they already have one, a third only if they already have two, and so on.

Parity progression ratios are calculated from the tabulation of women by parity using the formula:

$a_i=N_{i+1}/N_i$, $i= 0,1,2,...,n$

where a_i=PPR, N_i=number of women with at least i children ever born, N_i+_1=the number who go on to have at least one more and n=the ultimate parity achieved by the cohort of women. a_0 is the proportion among women with zero children who subsequently have at least one child, a_1, the proportion among those with at least one who subsequently have two children, and so on. Older women are usually selected in the calculation of PPRs. This is because their calculated PPRs will be close to their final PPRs whereas for younger women the calculated PPRs will not reflect their final fertility and thus will be too small (Newell, 1988). Mean number of children ever born can be computed from parity progression ratios of older women (i.e., 40 years and over) using the formula:

$MCEB=a_0 + a_0a_1 + a_0a_1a_2 + ... + a_0a_1 ...a_n$ where MCEB denotes mean number of children ever born (Feeney, 1988).

Parity progression ratios for ever married women aged 20 years and over are presented in five year age groups in Table 5.5. As pointed out above, the PPRs are lower for the younger women. However, it may be seen that a very high proportion of women become mothers even among the younger ones. For instance, nearly 90 per cent of women aged 20-24 and 95 per cent of those aged 25-29 had at least one live birth at the time of the survey. This is true in populations where marriage is early and the level of primary sterility is low. From Table 5.5 it may also be seen that among women aged 30 years and older, very high proportions go on to have at least one more live birth after having at least one and that the proportion of women who stop at low parity is extremely small.

Table 5.5 : Parity Progression Ratios per Ever Married Women.

children	age cohort of women					
ever born	20-24	25-29	30-34	35-39	40-44	45-49
0	0.890	0.949	0.960	0.970	0.975	0.973
1	0.652	0.888	0.925	0.967	0.952	0.938
2	0.474	0.803	0.904	0.920	0.947	0.919
3	0.385	0.603	0.852	0.887	0.940	0.904
4	0.267	0.506	0.702	0.837	0.863	0.893
5		0.402	0.654	0.794	0.846	0.866
6			0.548	0.707	0.781	0.839
7			0.451	0.648	0.778	0.822
8				0.537	0.677	0.702

Using the parity progression ratios it is possible to show the manner in which different family sizes are distributed in the population. That is, it is possible to compute say, out of 1000 women, the number who had at least i children and by subtraction, the number with exactly i children. For this purpose, women nearing the end of the childbearing years (i.e., those in the 40-44 and 45-49 age groups) are considered. In Table 5.5, for women aged 40-44, a_0 was 0.975, a_1 was 0.952, a_2 was 0.947 per woman and so on. This means out of 1000 women, 975 (1000x0.975) had at least one child and 25 (1000-975) never had a child; among the 975 women who had at least one child, 928 (975x0.952) had at least two children while 47 (975-928) had only one and so on. When the computation is carried out in a systematic fashion, it follows that among 1000 ever married women aged 40-44 in Central Ethiopia in 1986, we have: 975 with at least 1 and 25 with none; 928 with at least 2 and 47 with 1; 878 with at least 3 and 50 with 2; 825 with at least 4 and 53 with 3; 712 with at least 5 and 113 with 4; 602 with at least 6 and 110 with 5; 469 with at least 7 and 133 with 6; 364 with at least 8 and 105 with 7; and 246 with at least 9 and 118 with 8 children. Similarly for those aged 45-49, we have: 973 women with at least one and 27 with no child; 913 with at least two and 60 with 1 child; 839 with at least three and 74 with 2 children; 757 with at least four and 82 with 3 children; 679 with at least 5 and 78 with 4 children; 588 with at least 6 and 91 with 5 children; 494 with at least 7 and 94 with 6 children; 406 with at least 8 children and 88 with 7 children; 287 with at least 9 children and 119 with 8 children. Note that among women aged 45-49, the number with zero, one, two or three children is higher than the corresponding numbers for women aged 40-44 and that the number with four, five, six, seven or eight children is lower compared to those of the 40-44 age group. This suggests that perhaps due to relatively higher level of secondary sterility, a smaller proportion of women aged 45-49 moved on to have births of order four or higher compared to the 40-44 age group. The mean number of children ever born obtained from the parity progression ratios was 6.49 and 6.51 for ever married women in the 40-44 and 45-49 age groups respectively.

To sum up, the results presented in Tables 5.1 through 5.5 show that the population is characterised by high fertility. The mean parity achieved by a woman at the end of her childbearing span is over six and a half children. The age specific fertility rates describe a broadly peaked age pattern indicating a high level of reproductive activity especially for women between 20 and 40 years of age in which women had on average one child every four years. The total fertility rate was about 7 children per woman, the total marital fertility was about 8.8 children per currently married woman and the parity progression ratios indicate that substantially high proportions of women move on to higher order births.

5.4. Recent Trends

In the previous section, it was shown that the current level of fertility in the population of Central Ethiopia is high. This section considers the course of fertility in the recent past. As available data do not allow consideration of trends in the remote past due to truncation, the section attempts to examine trends during the last 15 years before the survey, the period since 1970. First, data on children ever born and births in the last 12 months obtained from the 1970 and the 1981 C.S.O surveys and those reconstructed from the 1986 M.O.H. survey birth history section are analyzed. This is followed by period cohort analysis of the birth history data.

5.4.1. Mean Parities and Age Specific Fertility Rates.

The mean parities by age group of women are presented in Table 5.6 together with the age specific and age specific marital fertility rates for 1970, 1981 and 1986 for the rural population as there were no comparable data for 1981 for the urban population because the 1981 Rural Demographic survey included the rural sedentary population only. The values of CEB and ASFRs for 1981 were generated from a clean version of the C.S.O. (1981) Survey Data Tape obtained from the Australian National University and may slightly differ from those produced by the C.S.O. (1985b). Also for reasons stated earlier, the 1986 ASFRs do not agree perfectly with those of Blacker (1986), Table 3.7.

The data show that substantial increase in the mean number of children ever born was recorded between 1970 and 1986. The increase was on average about 7 per cent for women aged between 20-34 but over 10 per cent for those aged 35 and over. For women aged 40-44, the reported mean parity increased by 0.6 children between 1970 and 1981 and by one child between 1981 and 1986. Similarly women aged 45-49 reported 0.6 children more in 1981 than in 1970 and 0.7 children more in 1986 than in 1981. Omission of children ever born in the earlier surveys might have contributed to part of this higher increase in the reported mean parities by the older women.

Mammo (1988) also has the view that there was some omission of children ever born in the 1970 and 1981 surveys.

Table 5.6 : Children Ever Born by Age Group of Women: Rural (1970,1981 and 1986).

	mean parity			ASFR			ASMFR		
age group	1970	1981	1986	1970	1981	1986	1970	1981	1986
15-19	0.34	0.33	0.36	0.133	0.117	0.146	0.174	0.208	0.249
20-24	1.48	1.60	1.72	0.254	0.264	0.27	0.257	0.302	0.344
25-29	2.64	2.88	3.19	0.240	0.260	0.298	0.247	0.295	0.329
30-34	3.82	4.06	4.26	0.167	0.251	0.281	0.219	0.276	0.305
35-39	4.72	5.22	5.49	0.137	0.237	0.270	0.161	0.241	0.291
40-44	4.80	5.41	6.41	0.052	0.106	0.190	0.113	0.171	0.205
45-49	5.14	5.86	6.66	0.045	0.046	0.080	0.071	0.113	0.106

Source: 1970: compiled from C.S.O. (1974); 1981: from C.S.O. (1981); 1986: M.O.H. (1986) data.

Figure 5.1(a) and 5.1(b) compare the age pattern of fertility at the three periods 1970, 1981 and 1986 for the rural population. Figure 5.1(a) compares the age specific fertility of all women while Figure 5.1(b) compares the age specific marital fertility. The rates presented in Figure 5.1(a) show that the values for 1986 were higher than those for 1981 and those for 1981 were higher than those for 1970 except for women under 20 years of age in 1970. These women had a little higher rates in 1970 but slightly lower rates in 1981. This suggests that if anything, fertility at younger ages has increased.

The age specific marital fertility presented in Figure 5.1(b) also shows that although the gap between the curves has been narrowed, the 1986 rates are higher than the 1981 rates and those of the 1981 are higher than those of the 1970 rates.

The figure also shows that the rates are much lower than those of the Hutterites fertility at younger ages but at older ages, the rates appear to be substantially higher. As pointed out earlier, errors of age misreporting and reference period might have affected the rates for the women aged 40 years and over.

The total fertility rates (TFR) computed from these data were 5.13 in 1970, 6.41 in 1981 and 7.70 in 1986. This shows that estimated TFR increased by 25.0 per cent between 1970 and 1981 and by 20.1 per cent between 1981 and 1986 in the rural areas. The increase in the reported TFR between 1970 and 1986 was about 2.60 children per woman.

Total Marital fertility (TMFR) increased from 6.50 in 1970 to 8.03 in 1981 (about 23.5 per cent) and in 1986, it further increased to 9.15 (13.9 per cent). The increase in TMFR was about 2.60 children per married woman between 1970 and 1986, the same as that of TFR in the rural areas.

As these rates were obtained from information on births in the last 12 months before the survey, they are usually affected by reference period errors (shorter or longer than 12 months) and may not indicate the true level of fertility in the population. Hence the Brass P/F ratio procedure was applied to the mean parity and current fertility data presented in Table 5.6 and the results are displayed in Table 5.7 together with the corresponding adjusting factors for 1970, 1981 and 1986. The adjusted age specific fertility rates are presented in Figure 5.1(c). These rates show that the adjusted rates are lower for 1970 than for 1981 and for 1981 than for 1986 also indicating a rising fertility.

Table 5.7. Adjusting Factors and Adjusted Age Specific Fertility Rates : Rural (1970, 1981 and 1986).

age	adjustment factor			adjusted fertility		
group	1970	1981	1986	1970	1981	1986
15-19	1.221	1.343	1.311	0.147	0.127	0.155
20-24	1.113	1.121	1.116	0.283	0.286	0.295
25-29	1.114	1.043	1.014	0.267	0.281	0.317
30-34	1.043	1.047	0.997	0.186	0.272	0.299
35-39	1.035	0.975	0.986	0.153	0.256	0.288
40-44	1.015	0.904	0.984	0.058	0.115	0.202
45-49	0.986	0.872	0.974	0.050	0.055	0.085
TFR	-	-	-	5.720	6.960	8.205

The age specific rates adjusted using the average of the adjusting factors for the 20-24 and 25-29 age groups resulted in a TFR of 5.72 for 1970, 6.96 for 1981 and 8.21 for 1986. Although the reported age specific rates for 1970 appear consistent compared to other years, they are less reliable. The rates for women aged 30 years and over are extremely low. This may in part be due to shorter reference period and in part due to lower fertility resulting from higher incidence of marriage dissolution or relatively higher level of secondary sterility in those days. It is important to note that the P/F ratio method is weak in the sense that it does not adjust for a downward bias on all ages in reporting of fertility.

Since the P/F ratio method adjusts the rates by using the data for women in their 20s as data from these women are assumed to be reliable and thus it does not incorporate life time fertility, the Gompertz model incorporating current and life time fertility (see Zaba, 1981) was applied to the data and the results are shown in Figures 5.2(a) through 5.2(c). Although distortions arising from age exaggeration, omission of children ever born and reference period errors have affected the data, particularly the 1970 and 1981 data as can be observed from Figures 5.2(a) and 5.2(b), the results of the fitted model clearly show an obvious rise in fertility. Estimates of the parameters **A** and **B** are obtained by combining the P and F points that appeared to be relatively correct and fitting least square line (r was over 0.98 in all cases). The resulting estimates of **A** for 1970, 1981 and 1986 were respectively 0.012, -0.1 and -0.09 while those for **B** were 0.81, 0.86 and 0.92 for 1970, 1981 and 1986 respectively. This shows that **A** declined while **B** increased between 1970 and 1986. The negative values of **A** indicate that childbearing has slightly moved to later years in the 1980s compared with the 1970s. The shift in the age of childbearing is further confirmed by the increase in the mean of the age specific fertility schedules during the period 1970 to 1986. The mean increased from 26.3 years in 1970 to 28.2 in 1981 and in 1986, it increased to 28.4 years.

The TFR estimates obtained from the fitted model were respectively 6.15, 6.8 and 7.18 for 1970, 1981 and 1986. Comparison of these figures with those obtained by the P/F ratio procedure shows that the Gompertz estimates are lower than the P/F ratio estimates for 1981 and 1986 while for 1970, it is higher.

Both the P/F ratio procedure as well as the Gompertz model indicate increasing fertility but the validity of the estimates depends on the correctness of the underlying assumptions and the model age specific fertility schedule used in obtaining these estimates. Moreover, as the reported rates were single year rates, apart from errors of reference period and omission, they might also have been affected by sampling errors. In order to reduce the error due to sampling and also to have a more direct insight into the pattern of childbearing in the population, the period-cohort rates obtained from the birth history data are considered in the section that follows.

5.4.2. Period - cohort fertility.

Table 5.8 (panels A to H) presents the period-cohort fertility rates, the cumulative fertility of cohorts at end of period and the cumulative within period fertility together with other measures. An examination of the rates in panel A indicates that fertility has increased substantially in the 15 years prior to the survey, but was approximately constant prior to that. The rise was higher especially for the younger age groups. For example, rates centred on age 30 (30-34 age group) increased by 26.5 per cent and those centred on age 25 (25-29 age group) increased by 29.3 per cent while those centred on age 20 (20-24 age group) increased by nearly 50 per cent during the period 15-19 years before the survey to 5-9 years before. The cumulated cohort rates in panel B also indicate similar increases over the period. The cumulated rates increased from about 1.2 children during the period 15-19 years before the survey to nearly 1.7 children for the most recent period for the 20-24 cohort and from about 2.3 children to 3.14 children for the 25-29 cohort while for the 30-34 cohort, it increased from 3.2 children to 4.4 children during the same period. Another interesting feature of panel B is that the values for the period 10-14 years before the survey (i.e., during 1971-1975) are more or less the same as the mean parities presented in Table 5.6 for 1970. Unless there were different types of errors of similar magnitude in both surveys, this indicates that omission or reference period errors were minimal for the younger cohorts.

However, it may be noted that cumulative cohort rates are based on the experience of several years and may not be good indicators of trends in fertility. Cumulative period rates provide better insight of trends. Panel C displays the cumulative period rates by five year periods before the survey. The rates show significant increase in fertility during the period 15-19 years to 5-9 years before the survey. For instance, the rates cumulated to age group 30-34 increased by about 33 per cent, those cumulated to age group 25-29 increased by nearly 37 per cent and those cumulated to age group 20-24 increased by 44 per cent during the period. The total fertility rate for the period was a little over 7 children per woman. This value is slightly lower than that obtained by Blacker (1986) from the unadjusted data. He obtained a total fertility of 7.6 births per woman for the most recent five years period before the survey.

Table 5.8 : Period - cohort Fertility, Cumulative Cohort and Period Fertility and P/F Ratios.

age cohort groups	N	periods before the survey						
		0-4	5-9	10-14	15-19	20-24	25-29	30-34
A)		period - cohort specific fertility rates						
15-19	568	0.127	0.171	0.160	0.147	0.134	0.132	0.128
20-24	475	0.251	0.256	0.229	0.173	0.170	0.137	
25-29	609	0.292	0.309	0.295	0.239	0.189		
30-34	533	0.275	0.325	0.305	0.257			
35-39	586	0.256	0.297	0.270				
40-44	363	0.189	0.247					
45-49	297	0.103						
B)		cumulative cohort fertility at end of period (P)						
15-19		0.294	0.444	0.401	0.330	0.283	0.275	0.269
20-24		1.699	1.681	1.475	1.148	1.125	0.954	
25-29		3.141	3.020	2.623	2.320	1.890		
30-34		4.395	4.248	3.845	3.184			
35-39		5.528	5.330	4.534				
40-44		6.275	5.769					
45-49		6.284						
C)		cumulative period fertility (F)						
15-19		0.294	0.444	0.401	0.330	0.283	0.275	0.269
20-24		1.549	1.724	1.546	1.195	1.133	0.960	
25-29		3.009	3.269	3.021	2.390	2.078		
30-34		4.384	4.894	4.546	3.675			
35-39		5.664	6.379	5.896				
40-44		6.609	7.614					
45-49		7.124						
D)				P/F ratios				
15-19		1.000	1.000	1.000	1.000	1.000	1.000	1.000
20-24		1.097	0.975	0.954	0.961	0.993	0.994	
25-29		1.044	0.924	0.868	0.971	0.914		
30-34		1.003	0.868	0.846	0.866			
35-39		0.976	0.836	0.769				
40-44		0.949	0.758					
45-49		0.882						

age cohort groups	period before the survey					
	0-4	5-9	10-14	15-19	20-24	25-29
E)	P/F ratios excluding common cells					
15-19	1.510	0.903	0.823	0.858	0.972	0.978
20-24	1.085	0.856	0.743	0.941	0.842	
25-29	1.004	0.802	0.768	0.795		
30-34	0.969	0.786	0.700			
35-39	0.941	0.711				
40-44	0.873					
F)	ratios of successive (Ps)					
15-19	1.510	0.903	0.823	0.858	0.972	0.978
20-24	0.989	0.877	0.778	0.980	0.848	
25-29	0.961	0.869	0.884	0.819		
30-34	0.967	0.905	0.824			
35-39	0.964	0.851				
40-44	0.919					
G)	ratios of successive (Fs)					
15-19	1.510	0.903	0.823	0.858	0.972	0.978
20-24	1.113	0.897	0.773	0.948	0.847	
25-29	1.086	0.924	0.791	0.869		
30-34	1.116	0.929	0.808			
35-39	1.126	0.924				
40-44	1.152					
H)	ratios of successive rates (fs)					
15-19	1.346	0.937	0.919	0.912	0.985	0.970
20-24	1.020	0.895	0.755	0.983	0.806	
25-29	1.058	0.955	0.810	0.735		
30-34	1.182	0.938	0.843			
35-39	1.160	0.909				
40-44	1.307					

Due to the increasing truncation of the age range with years prior to the survey, total cohort fertility could not be calculated directly. However, synthetic total fertility rates were calculated for the periods 5-9, 10-14 and 15-19 years before the survey by assuming that the available rates for the recent periods were applicable in case of truncation.

The values obtained were respectively 8.13, 7.65 and 6.78 children per woman for the period 5-9 10-14 and 15-19 years before the survey. The value for the period 5-9 years before the survey is nearly the same as that obtained by Blacker (1986) but those for the 10-14 and 15-19 years before the survey differed substantially. For example, Blacker (1986) estimated between 6.7 and 7.1 births per woman for the period 10-14 years before the survey (see Blacker, 1986 Table 3.4 p. 36). The value for the period 5-9 years before the survey appears to be much higher than the corresponding values for the period 0-4 years or 10-14 years before the survey. Blacker suggests that this is mainly due to the misdating of the births which have been made to cluster during the period 5-9 years before the survey. However, from the results of Table 5.8, it appears that this peak during the period 5-9 years before the survey may partly be due to a genuine fertility rise and partly due to displacement of some of the dates of birth of children.

The period 5-9 years before the survey corresponds roughly to the period 1976-1980. The earlier part of the period (1976 and 1977) coincided with internal turmoil and the Ethiopia-Somalia war while the later part (1978-1980) of the period coincided with the easing of domestic turmoil and the end of the war. During this period, most of the people mobilised for the war returned home. Modest increases in agricultural and industrial production occurred during 1978, 1979 and 1980. This might have led to a relative boom of births which might have compensated some of the births lost during the earlier parts of the period.

The decline observed for the period 0-4 years before the survey, on the other hand, may in part be due to problems of data quality (the so called Potter effect, Potter 1977) and in part due to the socio-economic problems in the country during the 1980s. In 1984/85, the country experienced the worst famine in its history.

Although the famine in Central Ethiopia was not as serious as it was in the northern regions (Wollo, Tigray and Eritrea), three awrajas (provinces) in Shoa region (Menzna Gishe, Yifatna Timuga and Kambatana Hadiya) were seriously affected. As a result, prices of cereals increased substantially and also there was a shortage of food in some parts. This might have led to postponement of some marriages and temporary migration of spouses of married women looking for work. In addition, a substantial number of people, particularly from Kambatana Hadiya, Menzna Gishe and Yifatna Timuga awrajas in Shoa region were resettled in the south and north western regions (see chapter 3). The drop in fertility for the period 0-4 years before the survey may in part be due to the effect of the famine.

The P/F ratios presented in panel D show a steadily declining trend with advancing age and period before the survey. In the absence of reporting errors, decline in the P/F ratios usually indicates rising fertility. However, the very low fertility rates of the oldest cohorts in the earliest periods suggest displacement of dates of birth from the most distant past towards the survey date. Errors of date displacement produce a heaping of births in the period 5-9 or 10-14 years before the survey and as a result produce an artificial decline in fertility for the most recent periods (Potter, 1977). Although such errors have possibly affected the fertility measures presented here, the fact that cohort cumulative fertility (Ps in panel B) for the most recent period (0-4 years before the survey) are higher than those for the 5-9 years or 10-14 years before the survey for the same age cohort strongly suggest that fertility has increased in the population during the period under investigation. Each of these measures indicate that higher and higher fertility was recorded as one moves from the more distant past up to 5-9 years prior to the survey and then a marginal decline for the most recent period (0-4 years prior to the survey). The P/F ratios also decline with advancing age and period before the survey. The other ratios (ratios of successive rates, Ps and Fs) also show similar trends.

The P/F ratios by age and marriage and motherhood durations are presented by period before the survey in Figures 5.3(a) through 5.3(c). The ratios for age group and marriage duration show a declining trend with advancing age or duration for each five year period prior to the survey. However, the decline was a little slower for the most recent five year period before the survey for marriage duration. The motherhood duration ratios also show a similar trend except for the most recent period where the ratios are more flat than for the subsequent periods. This also proves that there has been a fertility rise in the population. However, as the evaluation of the data indicated (see chapter 3), the data contained a sizeable amount of errors of displacement of dates and the higher rates recorded especially for the period 5-9 years before the survey may have slightly exaggerated the rise.

The cumulative period fertility up to age group 35-39 and duration 20-24 for marriage and motherhood durations for the three most recent five year periods prior to the survey presented in Table 5.9 indicate that in general fertility is higher in Arsi region than in Shoa and in rural than in urban areas. It also shows that urban fertility has been declining for each five year period starting from 10-14 years before the survey until the most recent period while rural fertility has been rising starting from about 15-19 years before the survey up to the period 5-9 years before and then declined for the most recent period. The decline in urban fertility appears to have started around 1974, around the time when urban land and housing were nationalized. The nationalization of urban land and housing resulted in severe housing shortage and led to doubled up households (see Rafiq and Hailemariam 1986). Thus the observed decline in fertility in the urban areas may partly be explained by the reduction in marriages due to lack of housing and by the reduction in sexual activities due to lack of privacy because of too many people living in the same room.

The cumulated cohort fertility for the most recent 5 year period is on average about 4 per cent higher than the corresponding value for the period 5-9 years before, and that for the 5-9 years before is over 17 per cent higher than for the period 10-14 years before. The results are consistent for age group and marriage and motherhood durations. This may indicate that sharp rises in fertility occurred during the period 5-9 years before the survey and for the recent five year period, fertility remained more or less constant.

Table 5.9 : Period Fertility Cumulated to Age Group 35-39 and Marriage and Motherhood Durations 20-24 for the Three most Recent Five Year Periods.

	age group 35-39			mar. dur 20-24			motherhood dur 20-24		
	period before the survey								
	0-4	5-9	10-14	0-4	5-9	10-14	0-4	5-9	10-14
Total	5.66	6.37	5.90	6.38	6.94	6.31	6.49	7.57	7.53
Arsi	6.87	7.41	6.10	7.77	7.95	6.55	7.82	8.66	8.00
Shoa	5.41	6.15	5.85	6.09	6.73	6.22	6.05	7.19	7.22
Rural	6.09	6.56	5.84	6.64	7.13	6.39	6.77	7.91	7.62
Urban	4.79	5.84	5.89	5.80	6.47	6.67	5.80	6.73	7.30

Although these measures are incomplete as they exclude the highest age and duration groups, they do provide directly comparable measures for the recent periods. Nevertheless, the interpretation of these results require some caution as errors of omission or displacement of dates may have exaggerated the results.

Table 5.10 presents cumulative period fertility to duration 20-24 for the three most recent periods by age at marriage and motherhood. Panel A presents the cumulated rates for the total sample while Panels B and C present these rates for the rural and Urban samples respectively. Panel A shows that the rates cumulated to marriage duration 20-24 for the most recent five year period before the survey are higher than those for the period 10-14 years before the survey except for women who married after age 18 and that the motherhood duration rates are slightly lower for the most recent period compared to those of the period 10-14 years before the survey.

From panel B, it can be observed that the most recent period rates cumulated to marriage duration 20-24 are slightly lower than those for the period 10-14 years before the survey for women who married before age 14 and for those after age 18. For those who married between 14 and 18 years of age, the rates appear to be slightly higher for the recent period compared to the period 10-14 years before. The rates cumulated to motherhood duration 20-24 on the other hand, are lower for the most recent period compared to the period 5-9 and 10-14 years before the survey except for women who had their first birth while 20-22 years old. For these women, the rates appear to be slightly higher compared to the 10-14 years before the survey but substantially lower compared to the 5-9 years period before the survey. In Panel C, except for those who married while under 14 years of age, the most recent period rates cumulated to marriage duration 20-24 are lower compared to the rates for the period 10-14 years before the survey, In fact these rates show a consistently declining fertility during the 10-14 years before the survey up to the period 0-4 years before the survey. This is also true for the motherhood duration rates.

Table 5.10 : Period Fertility Cumulated to Marriage and Motherhood Durations 20-24 by Age at First Marriage and Age at First Birth for the Three Most Recent Five Year Periods Before the Survey.

marriage duration 20-24				motherhood duration 20-24			
	period before the survey						
age at marriage	0-4	5-9	10-14	age at motherhood	0-4	5-9	10-14
A. Total							
< 14	6.47	6.63	6.41	< 17	6.33	7.28	7.46
14-15	6.56	6.94	6.35	17-19	6.75	7.53	7.35
16-18	6.45	6.55	6.33	20-22	6.69	7.73	7.54
18 +	6.18	6.50	6.31	23 +	6.18	6.68	6.21
B. Rural							
< 14	6.46	6.97	6.50	< 17	6.73	7.22	7.28
14-15	6.46	7.01	6.28	17-19	6.65	7.23	7.40
16-18	6.30	6.80	6.30	20-22	6.94	8.10	6.75
18 +	6.10	6.60	6.21	23 +	6.60	7.95	6.81
C. Urban							
< 14	6.42	6.60	5.74	< 17	5.56	7.40	7.62
14-15	5.89	6.81	6.97	17-19	6.04	6.78	7.06
16-18	5.75	6.18	6.48	20-22	6.41	6.55	6.63
18 +	5.79	6.11	6.50	23 +	4.34	5.15	5.32

In general, the data presented in Table 5.10 indicate no different trend than has been presented so far. The values for the most recent period are nearly the same as those for the period 10-14 years before while the rates for the period 5-9 years are higher than those for the adjacent periods in the rural areas and in the urban areas, the rates showed a declining trend starting from the period 10-14 years up to the most recent period before the survey.

Table 5.11 presents the cohort cumulative fertility by age for the three oldest cohorts. This table shows the achieved fertility of each cohort while they were at the same age. The measures show higher fertility for the younger cohorts at all ages.

Table 5.11 : Cumulative Cohort Fertility by Age, Region and Residence for the Three Oldest Cohorts.

	Age group					
	20-24	25-29	30-34	35-39	40-44	45-49
Total						
45-49	1.00	1.90	3.18	4.53	5.77	6.28
40-44	1.13	2.32	3.85	5.33	6.28	
35-39	1.15	2.26	4.25	5.56		
Arsi						
45-49	1.14	1.93	3.46	4.95	6.21	7.04
40-44	1.34	2.64	4.36	6.30	7.63	
35-39	0.95	2.48	4.31			
Shoa						
45-49	0.84	1.82	3.05	4.36	5.59	6.03
40-44	1.05	2.22	3.71	5.09	5.95	
35-39	1.14	2.61	4.19	5.36		
Urban						
45-49	0.96	1.62	3.06	4.13	4.96	5.19
40-44	1.32	2.39	3.90	5.07	5.46	
35-39	1.39	2.91	4.40	5.46		
Rural						
45-49	0.97	1.85	3.15	4.59	5.96	6.56
40-44	1.05	2.27	3.80	5.38	6.42	
35-39	0.99	2.45	4.13	5.42		

The cohort aged 40-44 at the time of the survey had on average 0.80 children more than the cohort aged 45-49 when they were 35-39 years old and when they ware 40-44 years old, the 40-44 age cohort had 0.51 more children than the 45-49 age cohort. Similarly, the 35-39 age cohort had on the average 1.03 children more than the 45-49 cohort when both were aged 35-39 years. The cohort cumulative rates for the 35-39 age group are also higher than those of the 40-44 by about 0.3

children when they were aged 35-39 years. By the time they reach age group 40-44, the 35-39 cohort may have much higher number of live births than the number attained by those in the 40-44 at the time of the survey when they were 35-39 years old. These results clearly indicate that younger cohorts had higher number of live births than the older ones while they were at the same age.

5.4.3. Fertility During the First Five Years of Marriage

In order to examine the pattern of childbearing within the first five years of marriage, mean number of children born by women who were in their first union at the time of the survey were computed and presented in Table 5.12. Due to small numbers of women, the means were computed for ten year duration groups except for durations 0-4 and 5-9. As can be observed from the table, at each age group of marriage, the 0-4 duration group shows extremely low means compared to higher duration groups. This is mainly due to incomplete exposure as these women had not yet been in union for five years. Excluding the 0-4 duration group, the means show a consistent decline with increasing duration since first marriage. Women in duration group 5-9 years had the highest mean number of live births compared to any other duration group. Among women who married before their 15th birthday, the mean number of live births within five years of marriage is 12 per cent lower for women of duration 10-19 years compared to those of 5-9 years and 33 per cent lower for those in the 20-29 year duration group relative to the 5-9 group. Similarly for those who married between 15 and 16 years of age, the means for the 10-19 duration group is 16 per cent lower than that for the 5-9 duration group and for the 20-29 group, it is 35 per cent lower relative to the 5-9 group. For those who married between 17 and 19 years of age and 20 years and over, the pattern is the same. Since women with shorter duration since first marriage (5-9,10-19) belong to the younger age cohort (i.e., under 35 years of age at survey) and those with longer durations (20 or more years since first marriage) belong to the older age cohort because of early age at first marriage, the data presented in Table 5.12 clearly show that for younger women the mean number of children born within the first five years of marriage is higher indicating that these groups of women tend to shorten spacing between the first and successive births. The extremely low values for duration groups 30 or more years may partly be due to omission of some children and partly due to past lower fertility.

Table 5.12 : Mean Number of Children Born Within Five Years of Marriage by Duration Since First Marriage and Age at First Marriage.

Duration since 1st marriage	age at first marriage				
	< 15	15 -16	17-19	20 and over	all ages
0-4	0.73	0.91	1.01	1.49	0.96
5-9	1.60	1.76	1.84	2.00	1.79
10-19	1.40	1.48	1.71	1.78	1.57
20-29	1.07	1.14	1.46	1.58	1.21
30 +	0.98	1.00	1.12		0.99
all durs	1.27	1.44	1.69	1.83	1.504

The table also shows that the mean number of live births within the first five years of marriage increase with increasing age at first marriage. Women who married under 17 years of age had smaller mean number of live births within five years of marriage at each duration group compared to those marrying at higher ages. This is perhaps due to adolescent sub-fecundity among those who married while under 17 years of age or due to frequent births among those who married at 17 years or latter in order to offset the loss due to late marriage.

The results presented so far show that fertility has been high in the population of Central Ethiopia and that recently it has been increasing. The following section attempts to provide the possible reasons for the persistent high level of fertility and also the reasons for the recent rise.

5.5. The Persistent High Fertility.

5.5.1. Customs and Institutions.

Like many parts of Sub-Saharan Africa, established customs and values favouring high fertility are strong in Ethiopia. Having many children is considered as a virtue and the desire to have children is a desire of righteousness. Acceptance of a number of the economic and social responsibilities and of the expected adult role in the community depends on parenthood. Full adult status is defined by the birth of children. A woman wins the respect of her husband and her in-laws when she becomes a mother. A man also gains respect and better social status in the community if he is married and has living children. Barrenness excites pity and sympathy and in most cases leads to marriage breakdown because apart from raising a person's socio-cultural status, having children ensures the continuation of the family name. A person without living children carries a social stigma and dying without living children, especially sons is a tragedy. These beliefs and practices are strongly held by christians, muslims and practitioners of the traditional faith. From these ethics of custom stems the widely expressed statement that children are gifts or blessings from God.

5.5.2. Universal and Early Marriage.

Earlier, it was stated that unlike most countries in this part of Sub-Saharan Africa, (Kenya, Somalia, Sudan) where marriage is relatively late (SMAM 19.5 or more) (Lesthaeghe, 1984), in Ethiopia, marriage is early. This is true for the population of central Ethiopia as well. For instance, among females aged 15-19 about 45 % had been married in 1986 and their median age at first marriage was 16 years. By age 25 more than 97% were married and the proportion remaining single at the end of the childbearing span was only 0.2 per cent. From these it may be concluded that marriage is universal and that the population has not yet participated in the recent general rise in age at first marriage that characterizes many populations of Sub-Saharan Africa. This early and universal marriage implies a longer duration of exposure to the risk of childbearing. Childbearing starts early and continues until the woman reaches menopause or the union is broken by widowhood or divorce and not compensated by remarriage. For example, among women aged under 25 years who had at least one live birth, a quarter had borne their first child before they were 17 years old, 50 per cent before they were 19 years old and 75 per cent before they were 22 years old in 1986. This shows that 75 per cent of these women will be exposed to the risk of childbearing for more than 20 years after the birth of their first child.

Although marriage breakdown appears to be common in the population, many remarry so that a very small portion of the reproductive span is spent out of union. Data are lacking to show how frequently divorced or widowed women remarry as the survey failed to collect detailed marriage histories. However, the data obtained from the question on number of times married among ever married women show that 32 per cent of all ever married women have been married more than once and 82 per cent of these were in union at the time of the survey. The age distribution of currently married women among those married more than once is presented in Table 5.13.

Table 5.13 : Percentage Distribution of Currently Married Women Among Women Married More than Once.

age group	Rural	Urban	Total
15-19	81.8	66.6	76.5
20-24	89.6	68.0	82.2
25-29	94.3	82.5	89.7
30-34	88.8	68.0	78.9
35-39	94.3	73.4	85.2
40-44	81.2	79.3	80.5
45-49	82.0	64.7	75.7
Total	88.3	72.7	82.6

The table shows that at each age group significant proportions of women whose first marriage was dissolved were in union at the time of the survey. The proportion is higher in the rural areas than in the urban areas. This may be because some of the widowed or divorced urban women tend to work as maids, bartenders or become prostitutes instead of being remarried. As pointed out earlier in Chapter Two, women depend on men for economic support and this dependency forces most of them to remarry immediately after the dissolution of their previous unions. After divorce, once it is ascertained that the woman is not pregnant from the previous spouse, remarriage takes place. As a result the waiting time from divorce to remarriage is about 3 months. In case of widowhood however, the waiting time ranges from 6 months to over a year. Consequently, women remain in union for more than 28 years of their reproductive span (in most cases less than 6 years is spent outside union). In non-contracepting populations, although the number of births may vary with duration of lactation and post-partum abstinence, it is directly related to the duration of reproductive time spent in union.

5.5.3. Economic Value of Children.

It was pointed out earlier (see Chapter Two) that the Ethiopian economy is based on subsistence agriculture and that the overwhelming majority of the rural population derive their livelihood from it. The economic explanation of high fertility suggests that high fertility is a consequence of poverty and subsistence agriculture. Nag et al (1979) state that although the emotional rewards of having children may also be assumed to provide the main motivations to parents in both industrial and peasant societies, the economic value of children may be assumed to provide an important motivation to parents in peasant societies. Boserup (1985) writes that subsistence agriculture where both women and children perform nearly all the agricultural work is conducive for large families and that the father of a large family is more likely to become a rich man than the father of a small family. Henin (n.d) also argues that the relative importance and cost of the factors of production underpin the high fertility cultures. Subsistence and peasant agriculture require a great deal of labour and the peasant cannot afford to hire outside labour. The cheapest source of farm labour are his children and as a result his motives to have as many children as possible are great. Caldwell (1982) argues that pre-transitional societies are characterized by a net flow of goods and services from children to the older generation and the reversal of the direction of this flow is the driving force behind fertility decline (see also Collins, 1983; De Tray, 1983). Other studies on the other hand, suggest that the economic value of children to parents is less than might have been assumed. Turke (1985) argues that parents are likely to invest in children throughout their life course and a system is unlikely to arise in which children more than return the resources and services their parents gave them when they were young. Cleland and Wilson (1987), after reviewing marital fertility transition in both developed and developing countries conclude that the absence of modern parity specific birth control in most traditional societies does not necessarily imply that children possess a high economic value and that fertility variations in pre-transitional societies do not appear to relate to variations in the economic role of children. Nevertheless, in Sub-Saharan Africa where investment in children is little and where parents can make demands on their grown up children by reminding them of their sacrifice while rearing them, high fertility constitutes a rational economic behaviour.

In Ethiopia as elsewhere in the developing countries, especially those of Sub-Saharan Africa, most mothers are confined to work in the household and the opportunity cost incurred by them due to childbearing and rearing is negligible. Educational facilities are limited and only a small proportion of the school age children attend school. Moreover, even for those attending school, the cost of education is minimal as public education is free. Furthermore, the extended kinship network provides the opportunity to disperse the cost from parents to close relatives. As a result, the cost of childbearing and rearing is small. Although the economic value of children in Ethiopia is a promising area for future research, from personal observations and scattered information (see ILO 1986, Sjostrom, 1981; Chang, 1973) it may be stated that children have an important role in the household economy in the rural areas. Children start working in the household as early as 5 years of age. Female children look after their younger siblings and male children help in other jobs. At about age 8, the girl starts preparing food, while the boy helps in the field. The recent C.S.O survey on the Rural Labour Participation shows that the labour participation rate was 66 per cent for male and 36 per cent for female children aged 10-14 (C.S.O. 1985a).

Apart from their contribution to the household economy in terms of labour inputs starting at an early age, absence of social security at old age or at times of insecurity is another factor that increases the motivation of parents for more children. Children provide various types of support to parents even after leaving the parental home and establishing their own homes. Male married children usually live close to the parent's residential unit and assist their parents by cultivating their land and also providing financial assistance for clothing and other expenses (e.g. medical care at times of sickness). Married female children usually live at a distance but they make frequent visits to their parents and assist their mothers in the house work. If there are no mature living sons, the son in-laws take the responsibility of sons and provide all sorts of support to their aging father and mother in-laws. At times of peak agricultural work or during repair or construction of new houses, they provide the necessary material support as well as the required labour inputs. Consequently, parents of many children have a better economic position and better respect in the community. From the results of a KAP survey in different parts of the country, it was shown that respondents considered economic benefits the primary motives for having a large number of children (Chang, 1973; Gebre Kiros, 1979).

5.5.4. Absence of Birth Control Methods.

The level of contraceptive knowledge and use in the population is negligible. From questions on knowledge and ever use of contraception the information presented in Table 5.14 was obtained.

Although a little over a quarter of the ever married women reported that they had some knowledge of at least one method of contraception, ever use is limited to a very small proportion. The proportion of women with some knowledge of at least one method is higher in the urban areas than in the rural. However, even in urban areas, ever use of any method is limited to less than 10 per cent. When knowledge and ever use of the modern effective methods (Pill, IUD, diaphragm, injection and sterilization) is considered, about a quarter of the ever married women reported that they know about the pill, 6 per cent IUD, 12.3 per cent injection and the proportion who reported knowledge about diaphragm and condom were 1.5 and 1.7 per cent respectively and use of any one of these methods was less than half a per cent except for the pill. The prevalence and ever use of these methods is not any greater even in urban areas where people are expected to have some knowledge of birth control methods because of the commercial availability of contraceptives in pharmacies and drug stores. From these results it may be concluded that the level of contraceptive prevalence in the population is negligible. The reason for this may partly be the lack of approval by both spouses. When ever married women living with their husbands were asked about the approval of the use of birth control methods, only 26 per cent reported that they approve while 30 per cent reported that they do not and 44 per cent reported that they were undecided. When these women were asked about the opinion of their spouse on the use of contraception, only 10 per cent reported that their spouses approve the use of contraception, 35 per cent said their spouses disapprove and 55 per cent did not know the opinion of their spouses. This shows that only a small proportion of husbands approve the use of birth control means and that most women do not discuss about family planning with their husbands.

Table 5.14 : Contraceptive Knowledge and Ever Use by Method and Rural Urban Residence: Ever Married Women.

	Knowledge			Ever use		
method	rural	urban	total	rural	urban	total
at least one method	32.3	64.2	35.6	4.0	27.6	6.5
prolonged abstinence	26.2	35.0	27.2	3.0	9.9	3.7
safe method	1.9	15.8	3.3	-	0.8	0.1
withdrawal	0.8	0.2	1.6	0.4	2.3	0.6
pill	20.3	59.5	24.3	0.7	13.5	2.0
IUD	2.6	34.0	5.8	-	2.6	0.3
Injection	9.6	36.2	12.3	0.4	0.9	0.2
Diaphragm	0.8	0.0	1.5	-	0.1	0.1
condom	0.7	10.9	1.7	-	0.3	0.2
Sterilization	4.3	25.6	0.5	-	1.7	0.2
others	0.8	-	5.1	-	0.3	0.1

Source: M.O.H. (1986).

Unlike the rest of Africa, even prolonged abstinence is not widely practised in Ethiopia. Among the christians, the period of abstinence ends when the child is christened which is 40 days for boys and 80 days for girls. For muslims, it ends when the woman stops bleeding after the birth of a new baby (which is not longer than 40 days). In fact this part of the east African region is known for its short duration of abstinence (Sudan, Ethiopia and Somalia) compared to countries in central and west Africa (see Lesthaeghe, 1986). However, the average period of abstinence is much longer than 40 days for first births. This is mainly due to the fact that in most cases women return to their parental home for delivery of the first child and stay there for nearly three years after the birth of the child.

As data on abstinence were collected only for the last and penultimate child (even this was not successful), this fact may not be properly demonstrated. However, examination of the median inter-birth intervals by period may assist in explaining this situation. Table 5.15 presents the results of life table analysis of birth intervals by period before the survey. It may be observed from the table that the median length of the second birth interval declined from nearly three years to just over two years while the third and fourth intervals declined by just only four months during the period 15-19 years to 0-4 years before the survey. It may also be observed from the table that the difference between the median second and third and fourth intervals declined from six months to a little over one month during the period. This clearly shows that there was a substantial decline in the second birth intervals during the period. Although birth intervals are closely related to age of the mother, the number of children she has already borne and the duration of breastfeeding, the observed decline in the second birth interval cannot be attributed to these alone as these would have similar effects on other intervals. It may partly be due to the decline in the period of stay of women in their parental home before returning to their husbands after delivery of the first child.

Table 5.15: Median Birth Interval Length by Birth Order and Period Before the Survey.

period before survey	birth order 2	3	4	difference 2 & 3	2 & 4
0-4	25.8	24.6	24.4	1.2	1.4
5-9	26.4	25.1	25.0	1.3	1.4
10-14	30.8	27.2	27.0	3.6	3.8
15-19	34.7	28.6	28.7	6.1	6.0

5.5.5. Relatively low level of Infertility.

Bongaarts and Potter (1983) define sterility (infecundity) as the physiological incapacity to produce a live birth. A distinction is made between primary sterility which refers to the inability to produce any live birth. Secondary sterility can occur at any time after having at least one live birth but as a working definition, it may be taken as a failure to produce a second or third birth after having at least one. Primary sterility is measured by the proportion of women with no live birth and secondary sterility by the proportion who fail to produce a second or third birth after bearing at least one among ever married women at about the end of their reproductive years. Secondary sterility usually occurs at older ages.

Among other factors, gonorrhoea and genital tuberculosis have been identified as the major causes of infertility. In natural fertility populations where these diseases are absent, sterility is low and varies little (Bongaarts and Potter, 1983).

High levels of infertility have been reported for Sub-Saharan Africa mainly due to widespread prevalence of gonorrhoea (Romaniuk, 1969; Frank, 1983; Bongaarts et al 1984). Frank (1983) shows that levels of childlessness averaged 12 per cent and small areas in central Africa displayed extremely high levels of 30-40 per cent. She reported that infertility accounts for 60 per cent of the variation in total fertility and that it was associated with a loss of at least one child per woman on the average for 18 countries of Sub-Saharan Africa. She identified gonorrhoea as the single most important cause of infertility in these countries.

In Ethiopia however, the level of infertility appears to be lower than the average for Sub-Saharan Africa but varies from region to region. Mammo and Morgan (1986) using a nationally representative sample of rural women from 12 regions of the country show that childlessness was about 12 per cent for women born before 1917 and a little over 5 per cent for those born since the 1930s. They also show that about 16 per cent of the older cohorts (born before 1917) and about 6 per cent of the younger ones (born since 1930s) had a first birth but not a second. They suggest that the decline is consistent with the sexually transmitted disease hypothesis.

Estimates of primary and secondary sterility made for the population of Central Ethiopia show that the levels are much lower than the average for the country reported by Mammo and Morgan. For rural women born before 1941 (i.e., aged at survey

45-49), the proportion childless was about 2.0 per cent and for those born between 1942 and 1946 (aged 40-44 at survey), it was 1.8 per cent. The corresponding figures in urban areas were 5.5 per cent and 3.7 per cent respectively for the older and younger cohorts. When both rural and urban areas were considered, 3.0 per cent of women born before 1941 and 2.5 per cent of those born between 1942 and 1946 were childless. The proportion with one or two children was 10.8 per cent for the older cohorts and 8.2 per cent for the younger ones in the rural areas while in the urban areas, 21.9 per cent of the births before 1941 and 14.6 per cent of those born between 1942 and 1946 had one or two live births. The proportion with 3 or more live births were 88 per cent for the older cohort and about 90 per cent for the younger cohort in the rural areas.

In the urban areas however, 73 per cent of the older cohorts and 82 per cent of the younger had 3 or more live births. The relatively higher proportion childless in the urban areas may in part be due to the higher proportion of widowed or divorced women in the urban areas than in the rural areas. For instance, 20.7 per cent of women aged 40-44 years and 35.6 per cent of those aged 45-49 years were either divorced or widowed in the urban areas while in the rural areas, 12.5 per cent of the 40-44 and 18.8 per cent of the 45-49 year old women were divorced or widowed. If divorce or widowhood occurred before child birth and if the woman remained unmarried for the rest of her reproductive life (which is the case for most women in the urban areas), her chance of having a child is very low as child birth out of wedlock is not acceptable in the society. The higher prevalence of sexually transmitted diseases in the urban areas might have also contributed to the higher proportion of low parity women. When both rural and urban areas are considered, 13.5 per cent of the women born before 1941 and 9.7 per cent of those born between 1942 and 1946 had one or two live births and the proportion with 3 or more live births were 84 per cent and 87 per cent respectively. These figures clearly show that the level of sterility in the population is substantially lower than for most of the Sub-Saharan African Countries. They also show that higher proportion of the younger women had larger number of live births than the older women. This may in part be due to the omission of children ever born by the older women and in part due to declining infertility.

Since infertility is closely related to the level of fertility in a population with natural fertility, a low level of infertility obviously leads to higher fertility.

5.5.6. The Status of Women.

Male supremacy and the subordination of women were the characteristics of the Ethiopian society until recently as a result of which the status of women remained low.

Women played a prominent role in agricultural production by carrying out complementary tasks with their spouses, (hoeing, sowing, weeding, harvesting, processing and marketing) in addition to their house work (preparing food, fetching water, fire wood, caring for children etc.). However, until recently, (significant changes have been taking place since the late 1970s) they did not benefit much from their toiling. They were not entitled to ownership of land which is the basic form of property in an agrarian society as inheritance of land to female children was not allowed especially in the central and southern regions. In addition, their spouses were in charge of whatever capital they could accumulate from petty trading or inherited from their parents. Consequently, women were totally dependent on their spouses and failure to produce children threatened the stability of marriage. Also economic support in case of widowhood, comes from children or in-laws. As a result, having many children is considered as an advantage. Studies elsewhere have shown that women faced with restrictions of a patriarchal social structure and limiting religious norms seek security through high fertility (Cain, 1981).

5.5.7. High Infant and Child Mortality.

Infant and child mortality have been and still remain very high in Ethiopia. It was shown earlier (see Chapter Two, Table 2.9) that in 1981, infant mortality was estimated to be 144 per 1000 live births and the probability of dying between 1-4 years of age was 92 per 1000 for rural Ethiopia. The probability of dying within the first year of life estimated using Trussell's regression approach (UN, 1983) applied to the 1981 data for rural Arsi and Shoa was 140 per 1000 live births and the probability of dying between 1-4 years as 78 per 1000. The same procedure applied to the 1986 data resulted in a value of 127 per 1000 for infant mortality and the probability of dying between 1-4 years of age as 69 per 1000. These results indicate that on average one out of every five children die before its fifth birth day. Blacker (1986) using the M.O.H. survey birth history data computed a neonatal and post neonatal mortality of 55 and 78 per 1000 respectively and a similar estimate of IMR as obtained above. He notes that the estimates of neonatal, post neonatal and infant mortality may be underestimates due to heaping of the age at death and also due to missing dates of birth for a substantial number of the births (Blacker, 1986). However, these estimates do indicate a high level of infant and child mortality in the population.

The effect of high infant and child mortality on fertility in a non-contracepting society is obvious. It has been shown in many societies that the birth interval tends to be shorter following the death of a child than when the child survives (Knodel, 1968; Preston, 1978; Cochrane and Zachariah, 1983). Soon after the death of the child, the effect of lactation on postpartum amenorrhoea is removed and the risk of conception increases. Also high infant and child mortality force parents to desire large number of children in order to secure the survival of some to adulthood. For instance, from the M.O.H. survey on desired number of children, it was observed that 41 per cent of the women reported that they wanted 6 or more children while 35.1 per cent reported that they did not know. The percentage of women who reported that they wanted 1-5 children was only 36.3 per cent and 2.7 per cent reported they did not want any children. Figure 5.4(a) presents the percentage distribution of currently married women who want more children by number of living children. The relationship between the percentage who want more children and the number of living children is inverse and linear. The higher the number of living children the lower the desire to have more. The mean desired number of children plotted against the number of living children presented in Figure 5.4(b) shows that women with three or fewer living children desired about 6.0 children while for those with four or more living children, the mean number desired steadily increased with increasing number of living children. This may be due to the fear of mortality. Even those with large number of living children were not sure that some desired number will grow to adulthood and as a result they desired higher number of children. Upward revision of desired number of children in response to increase in actual number of children and the tendency by the younger women with relatively few children to under-state the number they ultimately want to have may also lead to such relationship between number of living children and mean number of desired children (Lightbourne and McDonald, 1982). In addition, due to urbanization, increasing education and declining mortality among other things, young women may want to have lower average desired family size compared to older women. The relatively lower mean desired number by women with two or fewer living children may be because these group of women were young, urban residents or literate. This can be seen clearly from Table 5.16 where mean desired number of children is smaller for younger women than for older women, for urban residents than for rural residents and for literate ones than for the illiterate.

Table 5.16: Mean Desired Number of Children by Age Group, Residence and Literacy

Age	Residence		Literacy		
Group	Urban	Rural	Literate	Illiterate	Total
15-19	4.20	4.96	4.24	4.74	4.58
20-24	4.27	5.87	4.25	5.09	5.34
25-29	4.94	6.15	5.34	5.83	5.78
30-34	5.36	7.00	5.71	6.77	6.36
35-39	5.86	7.02	5.81	6.85	6.67
40-44	5.98	7.08	5.86	7.01	6.76
45-49	5.42	7.54	6.00	7.08	6.93

To sum up, the low status of women, high social and economic value of children, pro-natal customs and religious beliefs, low cost of rearing children, absence of birth control methods, early and universal marriage, low level of sterility, relatively shorter duration of postpartum abstinence, and high infant and child mortality appear to have worked in favour of high fertility in the population. However, as data are not available, it remains to be seen what the actual effect of these factors is on the observed level of fertility in the population.

5.6. The Recent Rise

In section 5.4, it was shown that fertility has been rising since about 10-14 years before the survey. In this section, an attempt is made to show whether this rise was due to changes in marriage pattern or change in marital fertility or both and if so what factors were responsible for these changes.

It was shown earlier that TFR increased by 25.0 per cent between 1970 and 1981 and by 20.1 per cent between 1981 and 1986 while total marital fertility increased by 23.5 per cent between 1970 and 1981 and by 13.9 per cent between 1981 and 1986 for the rural population. Based on the relationship that TFR = C_m x C_c x C_a x C_i x TF where C_m, C_c, C_a, C_i are the indices of marriage, contraception, induced abortion and post-partum infecundity and TF is the total fecundity rate, Bongaarts and Potter (1983) provide a method of decomposing the trend in fertility to the fertility inhibiting effects of the four proximate variables (marriage, contraception, induced abortion and post-partum infecundity). Using their approach and assuming that the effects of contraception and induced abortion are negligible in the population, C_m and C_i were computed for the three periods 1970, 1981 and 1986 and the change in the fertility rates were decomposed into the two components of the proximate variables (see Bongaarts and Potter, 1983 for details). The results show that between 1970 and 1981, of the total change in TFR, 16.0 per cent was due to changes in marital fertility and that the interaction term was 4.0 per cent. Between 1981 and 1986, changes in marriage pattern contributed 24.9 per cent while that due to marital fertility was 64.6 per cent and the remaining 10.5 per cent was due to the interaction effect. From these results, it may be concluded that the effect of other variables such as induced abortion, contraception, etc., on TFR was very small and that during both periods (i.e., 1970-1981 and 1981-1986), although changes in the pattern of marriage has also contributed to the increase in the TFR, it was the change in marital fertility that contributed a substantial proportion of the total increase.

5.6.1. Marriage Pattern

Figure 5.5(a) through 5.5(d) present the proportion of single, married, widowed and divorced women aged 15-49 in 1970, 1981 and 1986. It can easily be seen from figure 5.5(a) that the proportion single has slightly increased for the younger women (under 30) in 1981 and 1986 and that from figure 5.5(b), the proportion of women under 30 who were married was lower and that the proportion over 30 was higher in both 1981 and 1986 than in 1970. Figures 5.5(c) and 5.5(d) show that the proportions widowed and divorced were also higher for the younger women in 1981 and 1986 than in 1970. The relatively higher proportion of widowed women under 30 in 1981 and 1986 is mainly due to the effect of the civil war in the country. Since the age gap between husband and wife is on average about 6 years, and since younger men were drafted for the military service, the younger women were the ones who suffered most. On the other hand, higher proportion of women aged 30 and over reported to be married in 1981 and 1986 and the lower proportions widowed and divorced imply a relatively stable marriage probably due to lower mortality and the reduction in migration in the 1980s than in the 1970s. It was pointed out in Chapter Two that men migrate from place to place looking for work leaving behind their spouses and when spouses are asked to join their husbands at a latter date, either the spouses may not refuse or their parents may not allow them to join their husbands and as a result a marriage breaks. After the land reform however, this type of migration was substantially reduced. In a population where secondary sterility is low and contraceptive use is absent, higher proportion of married women in these age groups may bring a significant increase in fertility.

One of the major changes that occurred as a result of the 1974 Ethiopian Revolution was the land reform which nationalised and redistributed land and created a relative equality in terms of land holding among the peasantry. Due to the land reform, the lack of exposure resulting from temporary separation of spouse caused by seasonal labour migration has been removed. As pointed out earlier in Chapter Two, poor landless peasants or those with small holdings from the central highlands used to migrate to plantations on the Awash River or Rift Valley lakes or to the coffee regions in the south west as seasonal farm labourers and spent a considerable time away from home. Conception waits are longer among women who experience prolonged periods of separation from their spouses. For instance, Chowdhury, (1978) shows that a 1-4 months absence of husband increased the waiting time to conception by nearly 12 months and absence of 5 or more months increased it to over 15 months in Bangladesh. Mhloyi (1987) also argues that lack of exposure may have a negative effect on fertility beyond that of abstinence or amenorrhoea.

As a result of the 1974 land reform which nationalised and redistributed land and banned the hiring of private farm labour, the circulatory migration of peasants was stopped and peasants had to stay at home with their wives. This might have led to increased exposure to the risk of childbearing.

Another important change that has been taking place since the mid 1970s is the change in health policy from the elitist, curative and urban biased to preventive, mass based public health policy incorporating maternal and child health (MCH) programmes (CPSC, 1984). Also attempt has been made in the control, prevention and eradication of infectious and endemic diseases. It is believed that this effort has brought about some improvement in the general health of the population. For instance, Mammo (1988) shows that life expectancy increased from about 40 years in 1970 to about 48 (47.86) years in 1981 in rural Ethiopia. The value for Central Ethiopia in 1986 was about 52 years (Blacker, 1986).

Improvement in health can affect both the pattern of marriage as well as marital fertility and could lead to increases in fertility in the absence of fertility inhibiting factors. Mortality can be lowered and the incidence of widowhood can be reduced due to improvement in health. Also, the incidence of illness can be reduced which can in turn lead to reduced spontaneous abortion and successful pregnancy and child birth. Moreover, the loss of exposure due to illness of either spouse can be reduced. It appears that part of the increase in the TFR might have been brought about by these factors that resulted from the relative improvement in the health of the population.

5.6.2. Breastfeeding Pattern

Bongaarts (1978) reports that breastfeeding is the most important determinant of birth intervals in non-contracepting non-abstaining populations. The relationship between breastfeeding and postpartum amenorrhoea is well established. Several studies have demonstrated that the duration of postpartum amenorrhoea is shorter for non-breastfeeding mothers and consequently their fertility higher than for breastfeeding mothers (Buchman, 1975; Van Ginneken, 1977; Bongaarts, 1978; Bongaarts and Potter, 1983). Breastfeeding suppresses ovulation and menstruation and prolongs the waiting time for conception and leads to a longer inter-birth intervals. Bongaarts (1982) shows that the duration of post-partum infecundability is a function of the duration of breastfeeding in the absence of prolonged abstinence.

In Ethiopia, as pointed out earlier, the duration of abstinence is short except for first births and contraception is virtually absent. Breastfeeding has been the principal mechanism for spacing births. In the past, breastfeeding was generally considered as a norm. Not breastfeeding a child was a shame and mothers used to breastfeed their children until the next pregnancy or until the child refuses to be breastfed. There was no restriction of place or time as the child was fed on demand any where - in the market place, in the field, at home or during the night. Supplementary food was delayed until the child was at least six months old. This pattern of breastfeeding was common both in the rural as well as in the urban areas.

However, this pattern of prolonged breastfeeding has been changing since the mid 1960s. Although most women breastfeed their babies even today, the duration is much shorter than it used to be. Increasingly smaller and smaller proportion of women breastfeed their children for more than a year. In a recent study on breastfeeding practices in Ethiopia, it was reported that about 41.1 per cent of the urban women and 85 per cent of the rural women breastfeed their babies for about a year (Zewdie, 1981; WHO,1980). The duration of breastfeeding is shorter in the urban areas than in the rural areas and for younger women than for the older. Supplementary food is introduced within three to four months after the birth of the child. It was reported that the availability of commercially produced high protein, high energy breast-milk substitutes and the publicity carried out to popularize these products have played an important role in reducing the prevalence, intensity and duration of breastfeeding especially in the urban areas (WHO, 1980, Zewdie, 1981). For instance, a locally produced low cost, high protein, high energy weaning food 'FAFA' developed by the Ethiopian Nutrition Institute (ENI) has been available since the mid 1960s.

The effect of this change in the pattern of breastfeeding may be a relative decline in the duration of lactational amenorrhoea. Although the relationship between the average length of breastfeeding and that of post-partum amenorrhoea is not strictly linear, but logistic (Lesthaeghe et al 1981), the decline in the duration of effective breastfeeding (that is, without the introduction of supplementary food) from over six months to just about four months could lead to a marked decline in the duration of lactational amenorrhoea. Since lactational amenorrhoea is the only contributor to the non-susceptible period (as abstinence is short), a decline in breastfeeding leads to a decline in the non-susceptible period. In a natural fertility population, a decline in the non-susceptible period leads to an increase in marital fertility. Lesthaeghe et al (1981) argue that in a population with 2 per cent sterility level and a fecundity of 0.15, a small reduction in the non-susceptible period of 3 months starting from 24 months increases the total marital fertility by 0.5 live births. Most of the observed increase in the total marital fertility appears to be mainly due to the changing pattern of breastfeeding which in effect has shortened the length of post-partum amenorrhoea.

5.7. Summary and conclusion

By making use of data from the various surveys, the chapter has established the levels and trends of fertility in the regions of Arsi and Shoa of Central Ethiopia. It has also attempted to explain the likely causes of high and rising fertility.

Although errors of omission of children ever born and the wrong perception of the reference period for births in the last 12 months have affected the data in the earlier surveys and displacement in time of the date of births affected the 1986 birth history more than omission of children ever born, there is a clear indication of fertility rise in the population. The estimates obtained from the indirect techniques (P/F ratio and Gompertz), although slightly different in levels, were consistent in showing trends. These estimates show that total fertility was about 6.15 children per woman in 1970, 6.76 children per woman in 1981 and 7.18 children in 1986 indicating a rising fertility which could not be attributed to improvement in data quality alone.

The period - cohort analysis shows that fertility was relatively constant during the earlier parts of the 1960s, began to increase moderately towards the end of the 1960s and continued without much change until about the mid 1970s. It then accelerated during the later parts of the 1970s after which some decline occurred during the 1980s. Estimated total synthetic cohort fertility increased from 6.7 during 1971-1975 to 8.13 during 1976 to 1980 and during 1981-1986, it declined to 7.12 children per woman.

These results support the recent suggestion in the modern demographic transition theory that fertility initially rises before it starts to decline (Dyson and Murphy, 1986; Caldwell, 1982; Romaniuk, 1980; Beaver, 1975). However, as stated earlier, the decline in the most recent period after a peak rise during the period 5-9 years before the survey may partly be due to data problems and partly due to the socio-economic problems in the country in the 1980s and may not be sustainable. This is because the desire to have many children is great even among the younger women, infant and child mortality remain high, the decline in lactational amenorrhoea is not yet compensated by contraception and that marriage remains early and universal. Unless accelerated changes occur in these variables, it is unreasonable to expect any decline in fertility in the very near future.

As stated earlier, fundamental socio-economic changes have been taking place in the country each of which may have some effect on fertility. First, the formation of the Women's Association with a membership of 60 per cent of all women aged 15 and over in 1984 may serve as a platform for disseminating family planning information and population education. Second, the change in the health policy will undoubtedly have some effect in reducing infant and child mortality. Third, the rapid increase in education and the ongoing literacy campaign from which women are the most beneficiaries may also contribute towards a decline in infant and child mortality and consequently a decline in fertility. Education, working through the proximate determinants, demand, cost and benefit of children, has a depressing effect on fertility. In a comprehensive examination of reported findings on the relationship between education and fertility, Cochrane (1979), concludes that although increasing educational levels may at first be associated with increasing fertility, as the process continues fertility ultimately falls. Caldwell (1980) also underlines the association between onset of sustained fertility decline and attainment of mass education. Education raises the age at first marriage, increases the cost of rearing children and reduces their contribution to the household labour. Educated women may easily abandon traditional beliefs and practices regarding large families and adopt the practice of modern birth control without much moral strain.

However, these changes will take a considerable time to have some influence on fertility and hence fertility may remain at its current level of about 7 children per woman or it may rise to a higher level in the next few years.

In order to achieve rapid decline in fertility, policy makers should accelerate the type of changes mentioned earlier and increase their coverage to the rural population. They may also have to introduce an effective family planning programme, provide services within the reach of the people and create work opportunities for young women as an alternative to early marriage.

Figure 5.1(a): Reported age specific fertility rates:Rural Arsi and Shoa (1970, 1981 and 1986).

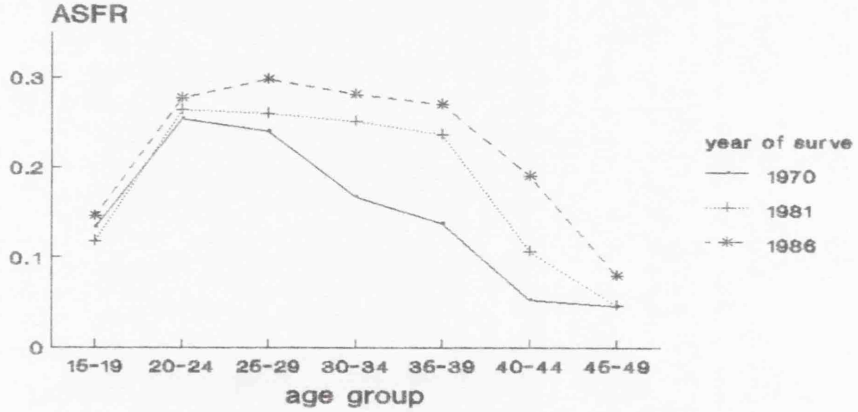


Figure 5.1(b): Reported age specific marital fertility rates: Rural Arsi and Shoa (1970, 1981 and 1986).

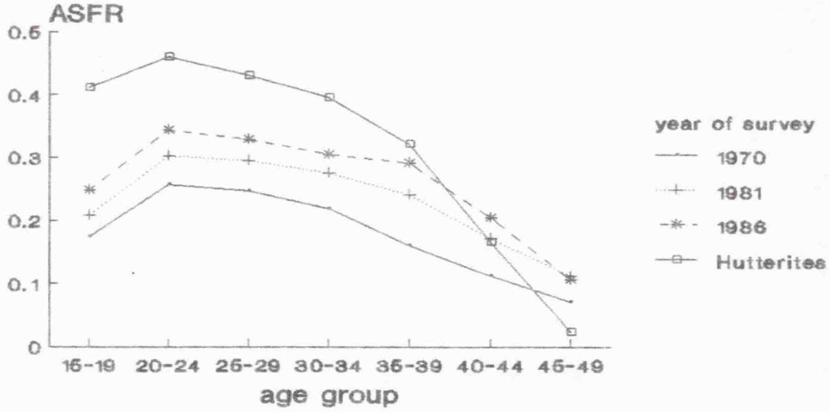


Figure 5.1(c): Adjusted age specific fertility : Rural Arsi and Shoa (1970, 1981 and 1986).

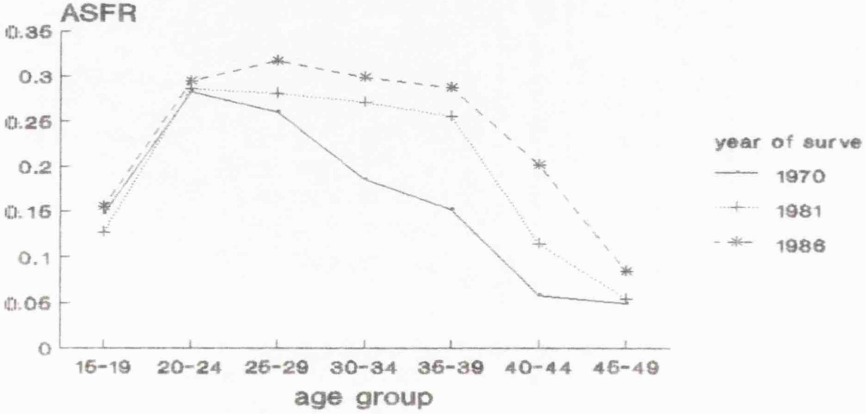
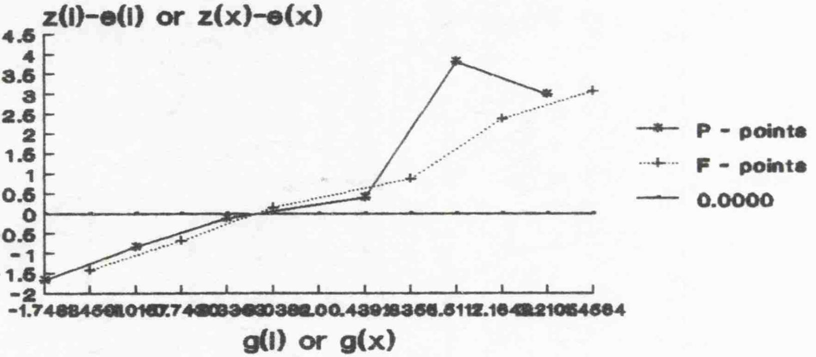
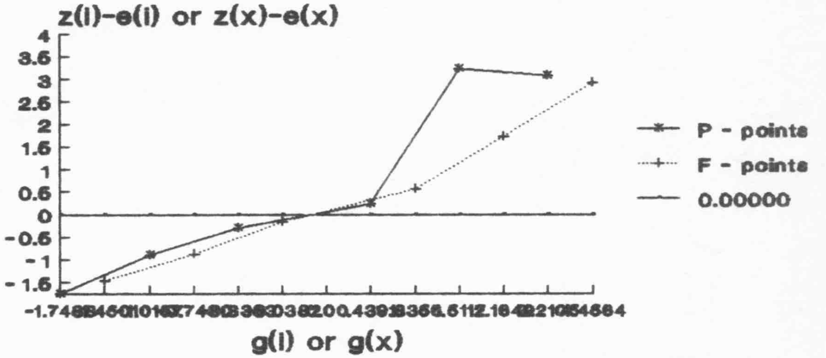


Figure 5.2(a) Relational gompertz model fitted to NSS2 survey data for Arsi and Shoa regions (rural population)



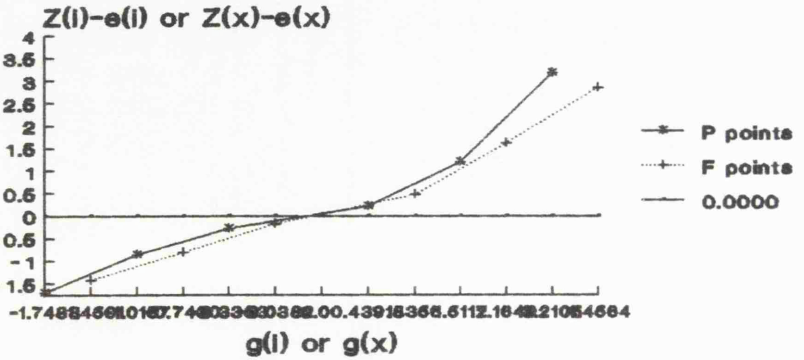
z(i)-e(i) correspond to P ponts and
z(x)-e(x) correspond to F points.
Similarly g(i) and g(x).

Figure 5.2(b) Relational gompertz model fitted to 1981 survey data for Arsi and Shoa regions (rural population)



z(i)-e(i) correspond to P points and
z(x)-e(x) correspond to F points.
Similarly g(i) and g(x).

Figure 5.2(c): Relational gompertz model fitted to 1986 survey data for Arsi and Shoa regions (rural population)



Z(i)-e(i) correspond to P points and
Z(x)-e(x) correspond to F points.
Similarly g(i) and g(x)

Figure 5.3(a) : P/F ratios by Period before the survey

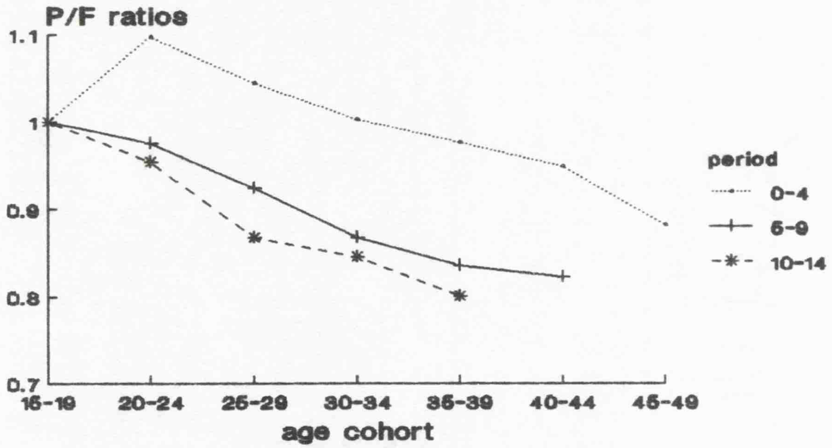


Figure 5.3(b) : P/F ratios by Marriage duration and Period Before the Survey

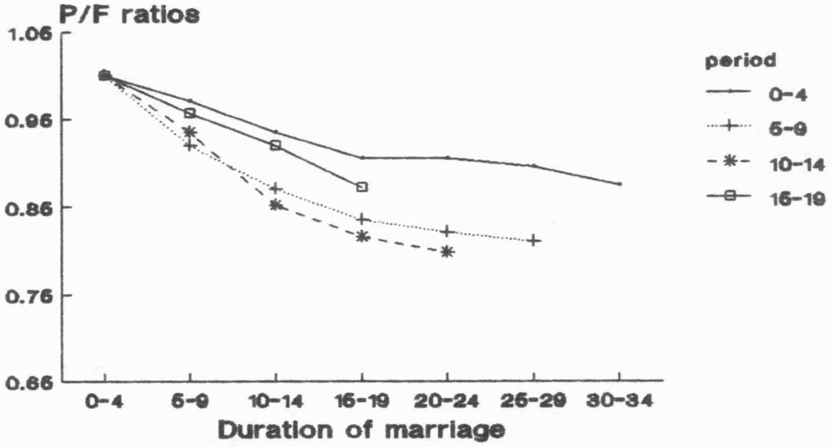


Figure 5.3c: P/F ratios by Motherhood Duration and Period Before the Survey Total surveyed Population

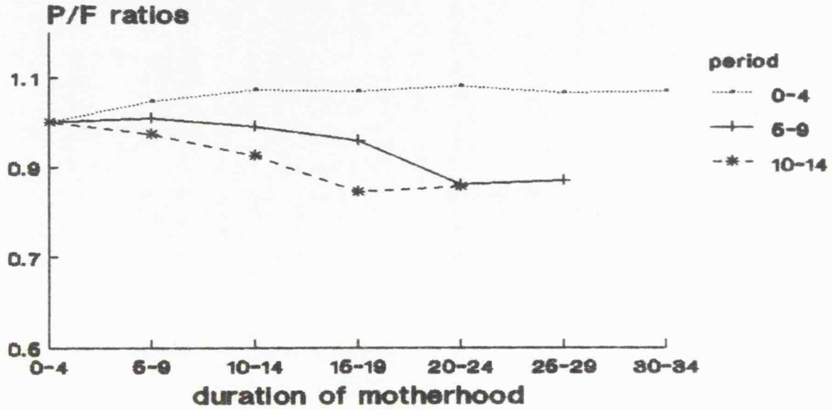


Figure 5.4(a): Distribution of currently married women who want more children by number of living children (1986)

Figure 5.4 (b) : Mean number of desired children by number of living children

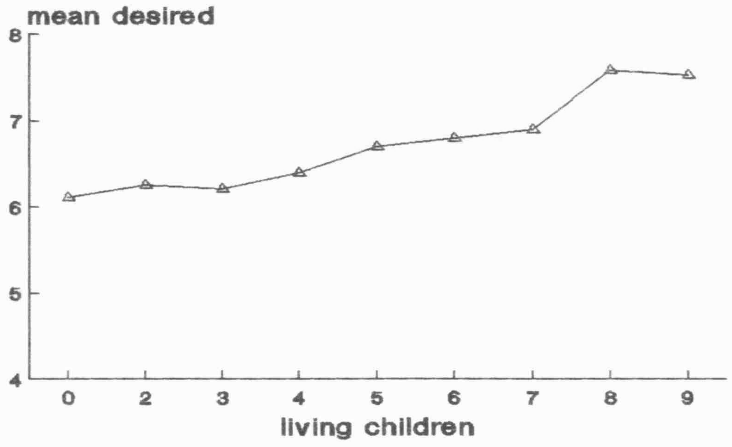


Figure 5.5a ; Percentage Distribution of Single Women by age group: Rural (1970, 1981 and 1986).

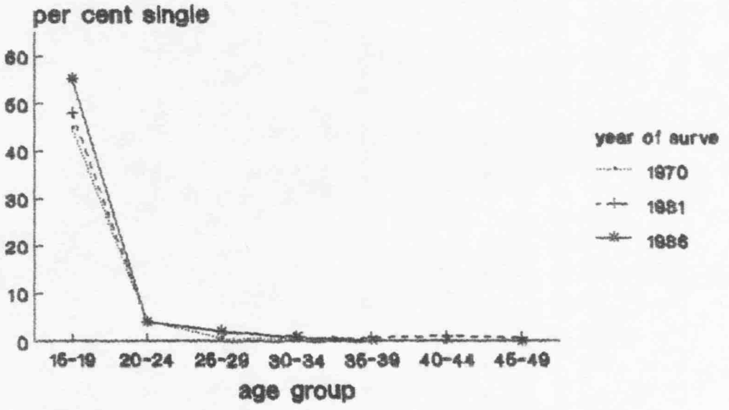


Figure 5.5b : Percent Distribution of Currently Married Women by age group: Rural (1970, 1981 and 1986).

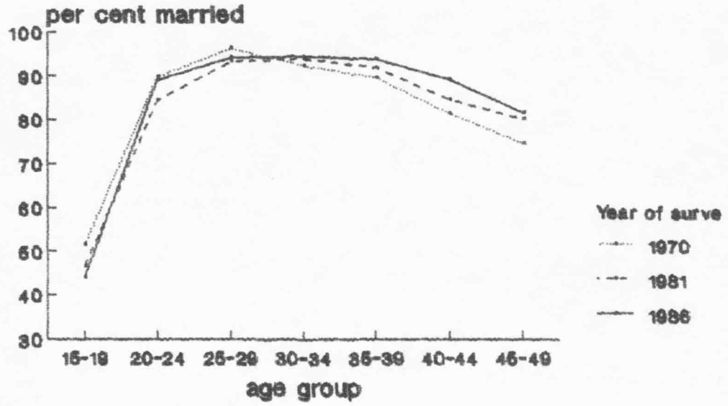


Figure 5.5c : Percentage Distribution of currently widowed women by age group: Rural (1970, 1981 and 1986).

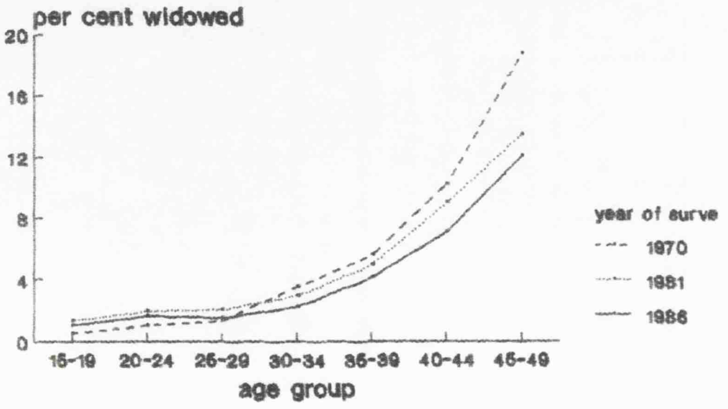
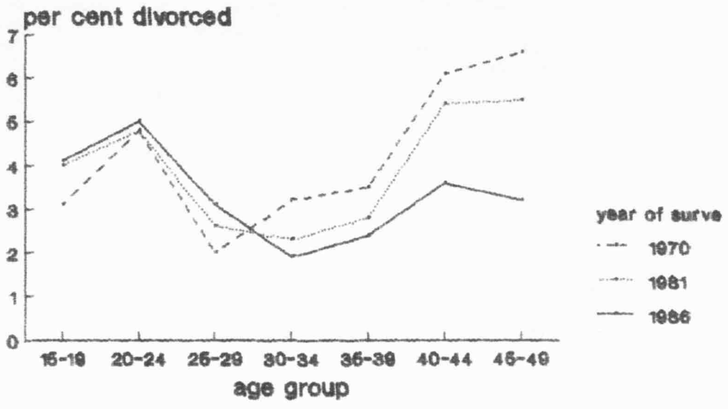


Figure 5.5d : Percentage of Currently Divorced Women by Age group: Rural (1970, 1981 and 1986).



CHAPTER VI

FERTILITY DIFFERENTIALS

6.1. Introduction

Human fertility is a complex phenomenon. The reproductive performance of a female is not influenced by biological factors alone but also by a number of social, economic, cultural, environmental and behaviourial factors which interact with each other as well as with the biological factors.

As a result variations in human fertility have been documented in different populations or designated categories of the same population as for example, among those who adhere to certain religious doctrine, or between those who live in urban areas as against those who live in rural areas, among those of different ethnic origin and so on.

In this chapter, the focus is to investigate the reproductive behaviour of women at individual level in relation to such socio-economic factors as residence, religion, literacy, ethnicity, age at first marriage, marital stability, and approval of family planning. The investigation is based on 2,992 ever married women from a total of 3,431 women of childbearing age. These women belonged to the four ethnic groups, Amhara, Oromo, Gurage and Kambatana Hadiya. These ethnic groups differ in the number of persons as well as in various socio-economic and demographic characteristics. The Oromo are the majority ethnic group and the Amhara stand second to them while the Gurage and the Kambatana Hadiya belong to the minority ethnic groups in the country.

As Table 6.1 shows, 31 per cent of the Amhara, 20 per cent of the Oromo, 19 per cent of the Gurage and 25 per cent of the Kambatana Hadiya were urban residents among the ever married women in our sample and the overall proportion urban was 24 per cent. In terms of religion, 97 per cent of the Amhara, 71 per cent of the Oromo, 27 per cent of the Gurage and 82 per cent of the Kambatana Hadiya women were reported to be Christian. However, unlike the other ethnic groups, most of the Kambatana Hadiya women belonged not to the Ethiopian Orthodox Church but to a different denomination, namely, Protestant Christianity.

Table 6.1. Percentage Distribution of the Ever Married Women by Socio-economic Background Characteristics.

	Ethnic groups				
	Amhara	Oromo	Gurage	Kamb. & Had.	Total
Residence					
Urban	31 (269)	20 (245)	19 (102)	25 (90)	24 (706)
Rural	69 (599)	80 (982)	81 (437)	75 (269)	76 (2287)
Religion					
Christian	97 (842)	71 (871)	27 (146)	82 (294)	72 (2153)
Muslim	3 (26)	29 (356)	73 (393)	18 (65)	28 (840)
Literacy					
Literate	51 (443)	19 (233)	20 (108)	10 (36)	27 (820)
Illiterate	49 (425)	81 (994)	80 (431)	90 (323)	73 (2173)
Total	29 (868)	41 (1227)	18 (539)	12 (359)	100 (2992)

Note: Quantities in bracket are number of women.

Literacy appears to be highest for the Amhara ethnic group with a little over 50 per cent of the ever married women in the sample being literate. This may partly be due to their strong association to the Orthodox Church which has a long tradition of providing church education and partly due to the higher social and political status held by them than the other ethnic groups. The proportion literate among the other ethnic groups was 20 per cent or less. The Kambatana Hadiya appear to be the least literate with only 10 per cent of the ever married women being literate.

Although pathological sterility is not a serious factor and family planning is not widely used in this population (see Chapter Five), the fact that women differed in the socio-economic characteristics may lead to differential fertility. This is because these differences in socio-economic variables are known to cause differences in the age at first marriage, marital disruption, approval and use of family planning, and many other biological and behaviourial variables that directly affect fertility (Davis and Blake, 1956). For instance a glance at Table 6.2 shows that there are differences in the proportion marrying at various ages and the proportion in stable union among the ever married women. For example, more than three quarter of the Amhara, Oromo and Gurage women married before they were 18 years old while about 67 per cent of the Kambatana Hadiya married before this age. Marital breakdown is very common among the Amhara than any other ethnic group (see also Figures 6.5 through 6.10).

Table 6.2. Percentage Distribution of Ever Married Women by Ethnicity and Demographic Background variables.

	Amhara	Oromo	Gurage	Kam. Had.	Total
Age at marriage					
< 15	28 (243)	26 (319)	28 (151)	12 (43)	25 (756)
15-17	55 (477)	52 (63)	52 (280)	56 (201)	53 (1596)
18 & +	17 (148)	22 (270)	20 (108)	32 (115()	22 (641)
Marital stability*					
stable	39 (339)	64 (785)	75 (404)	82 (294)	61 (1822)
not stable	61 (529)	36 (441)	25 (135)	18 (65)	39 (1170)
Approval of family planning					
approve	42 (364)	37 (453)	18 (65)	10 (36)	32 (957)
no	58 (504)	63 (775)	82 (294)	90 (323)	68 (2035)
Total	29 (868)	41 (1227)	18 (539)	12 (359)	100 (2992)

Note: Figures in brackets represent number of women.
* a marriage is said to be stable if first marriage is intact at the time of the survey.

Although the relationship between a dependent variable and a set of categorical explanatory (independent) variables can be studied using standardization or dummy variable regression among others, multiple classification analysis (Andrews et al., 1973) is employed in this chapter to investigate differential fertility. Multiple classification analysis (MCA) is a multivariate statistical technique which controls simultaneously a number of explanatory variables within the context of an additive model. Unlike standardization, it does not require a standard population which is based on certain arbitrary assumptions and unlike dummy variable regression or other statistical techniques, it does not assume linearity or monotonicity as to the relationship of the dependent variable to the independent variables. Moreover, in MCA, each class of each predictor becomes, in essence, a dummy variable without necessitating the analyst to create a dummy variable and yet the numerical results of MCA are identical to those of dummy variable regression after simple mathematical operations (Andrews et al., 1973).

The MCA model can be explained by the following equation:

$$Y_{ijk}... = Y + A_i + B_j + ... + e_{ijk}...$$

where $Y_{ijk}...$ = value of a variable for the individual in ith category of predictor **A**, jth category of predictor B, etc., **Y** = grand mean, A_i = added effect of ith category of predictor **A** (difference between **Y** and the mean of ith category of predictor **A**), B_j = added effect of jth category of predictor B (difference between **Y** and mean of jth category of predictor B), $e_{ijk}...$ = residual. The coefficients A_i, B_j, etc are estimated by minimizing the sum of squared residuals and solving the resulting system of linear equations.

The MCA results are usually presented in a table which contains the gross and net effects (deviations) of each predictor variable on the dependent variable. The gross effect denotes difference between the grand mean and the mean value for a variable with a specified attribute. The net effect denotes the difference between the grand mean and the mean for a variable with a specified attribute after controlling the effect of all other predictor variables. In addition to the gross and net effects, an MCA table provides other statistics which reveal the closeness of the relationship between the predictor and the dependent variable. For example, **eta**, the correlation ratio, shows how well a given predictor explains the variation in the dependent variable. The proportion of the variation in the dependent variable explained by the predictor in gross terms is measured by eta^2. **Beta**, on the other hand, measures on the basis of the adjusted means, the ability of a given predictor to account for variation in the dependent variable. The proportion of the variation in the dependent variable explained by the predictor variable after taking into account the proportion explained by other predictors is measured by **beta**^{2}. Another useful statistic is the conventional coefficient of multiple determination, **R**^{2} which measures the proportion of the variance in the dependent variable explained by using the coefficients obtained in an additive model applied to the data cases used in the analysis.

We have used children ever born to ever married women as a dependent variable. Two categories of region (Arsi, Shoa), residence (rural, urban) literacy (literate, illiterate), religion (christian, muslim) and four categories of Ethnicity (Amhara, Oromo, Gurage and Kambatana Hadiya) were used as socio-economic determinants of children ever born as predictors. Literacy was preferred to number of years of schooling mainly because of small number of women reporting a certain number of years of education. Age at first marriage, marital stability and respondent's approval of family planning were used as demographic determinants of fertility as predictors in the MCA model. Age at first marriage was grouped into three categories - those who married before age 15, between 15 and 17 years and those at 18 years or older. The inclusion of an open ended upper age category may introduce some uncontrolled variation among subgroups because of possibly highly variable mean age of those in the age interval. However, as most women marry by age 25 (nearly 90 per cent), the effect of this on the results is expected to be negligible. Marital stability was grouped in two categories - those for whom firs marriage was intact and those for whom it was not. Respondent's approval of family planning was also grouped in two categories - those who approved of family planning and those who did not. Age at survey was included as a covariate (a continuous variable and unlike the categorical variables, its effect is not directly observable) because although it is not by itself a variable that advances our understanding of fertility variation, the manner in which fertility varies with age is well known (that is, children ever born increase with age) and it is not reasonable to exclude it from an analysis of fertility (Kendall and O'Muircheartaigh, 1977).

These variables may not be the only socio-economic and demographic determinants of fertility in the population. Such socio-economic variables as household type (extended or nuclear), employment status and occupation of either spouse, and household income among others and demographic determinants such as induced abortion, contraception, breastfeeding, etc., are also important determinants of fertility. However, it was not possible to include these variables in our analysis because of lack of information. For instance, no attempt was made to collect information on abortion, employment or occupation, husbands education, or on household income or its proxy. Moreover, information collected for some variables (e,g., relationship of household members to head of household) was not coded and for others (such as breastfeeding and abstinence), correct information was collected for only a small number of women. Therefore, it is worth pointing out that our model may not be the best model in describing differential fertility in the population mainly because of lack of appropriate data. However, it is hoped to provide some idea about fertility differentials in the population and also the socio-economic and demographic variables that affect it.

Separate analyses were carried out for all ever married women, ever married urban women, ever married rural women and ever married women from each of the four ethnic groups Amhara, Oromo, Gurage and Kambatana Hadiya. This stratified approach makes it possible to observe behaviourial differences as well as the robustness of the results across various subgroups of the population and it also makes it possible to control for certain un observable cultural or environmental factors which might otherwise bias the results. Moreover, since the MCA technique deals with the between category effects and does not handle the within category effects, such effects may be handled by this stratified analysis.

The analysis was carried out for ever married women in the entire childbearing age group (15-49) and then separately for each of three age groups 15-24, 25-34 and 35-49 representing respectively the relatively young cohort of women who had been married fairly recently, those in the midst of the family building process and those who were completing their family building process. This allows one to observe life cycle or cohort effects. For example, as a result of decreasing family size norms and the acceptance of efficient family planning methods, fertility may decline or as health improves and traditional practices limiting fertility weaken (which is actually the case here), fertility may increase and the factors that bring these changes may differ in younger age groups from those in older age groups.

In each case, interaction between the predictors was examined using analysis of variance and no significant interaction effect was present.

6.2. Overall Fertility Differential

The section reports on the multiple classification analyses of the determinants of fertility for the full sample of ever married women. The analyses provide a good overview of fertility determinants for central Ethiopia. Subsequent sections carry the investigation further by considering separate analyses for rural women, urban women and women from each of the four ethnic groups.

Table 6.3 presents the results of the multiple classification analysis applied to all ever married women aged 15-49. The overall sample average was 4.30 children per ever married woman and is shown at the bottom of the table. The values shown on the unadjusted mean column are the sample averages for the various subgroups while those on the adjusted mean column are the averages obtained after controlling for the effects of the other predictors. Values of eta and beta, that is the measures that explain respectively the gross and net effects of each predictor are also given. Note that the eta and beta values are not the squared values.

Table 6.3 : Unadjusted and Adjusted Mean Number of Children Ever Born to Ever Married Women Aged 15-49.

Background variables	unadjusted mean	Eta	Adjusted mean	Beta
Region				
Arsi	5.02		4.81	
Shoa	4.16	.11	4.20	.08
Residence				
Rural	4.33		4.32	
Urban	4.21	.02	4.23	.01
Literacy				
Literate	3.76		3.90	
Illiterate	4.46	.11	4.42	.08
Religion				
Christian	4.21		4.22	
Muslim	4.51	.05	4.49	.04
Ethnicity				
Amhara	4.16		4.26	
Oromo	4.28		4.22	
Gurage	4.42		4.57	
Kam. + Had.	4.52	.04	4.78	.06
Age at marriage				
< 15	4.64		4.59	
15 - 17	4.29		4.35	
18 or more	3.93	.09	3.82	.10
Marital Stability				
Stable	4.49		4.53	
Not stable	4.06	.04	3.63	.13
Approval of Fp				
Yes	4.72		4.96	
No	4.10	.10	4.00	.16
Grand mean	4.30			
N	2992			
R squared				0.46

The unadjusted means (sample means) are obtained by adding the unadjusted factor effects (or unadjusted deviations as they are usually called) to the grand (overall or sample) mean and the adjusted means by adding the adjusted effects (deviations) to the grand mean. Table 6.4 presents the results of the analyses carried out separately for ever married women in the 15-24, 25-34 and 35-49 age groups. The figures under the unadjusted and adjusted columns are defined in a similar way as those in Table 6.3.

Table 6.4 : Unadjusted and Adjusted Mean Number of Children Ever Born to All Ever Married women by Age Group.

	Unadjusted means				adjusted means		
Background variables	15-24	25-34	35-49		15-24	25-34	35-49
Region							
Arsi	1.68	4.07	6.77		1.64	3.83	6.25
Shoa	1.49	3.73	5.78		1.50	3.57	5.82
Eta	.06	.06	.14	Beta	.04	.04	.06
Residence							
Rural	1.51	3.77	6.05		1.55	3.81	5.96
Urban	1.54	3.79	5.47		1.44	3.72	5.73
Eta	.01	.00	.09	Beta	.04	.02	.03
Literacy							
Literate	1.50	3.72	5.37		1.51	3.71	5.51
Illiterate	1.53	3.81	6.01		1.51	3.81	6.07
Eta	.01	.02	.08	Beta	.00	.02	.05
Religion							
Christ.	1.46	3.54	5.74		1.50	3.66	5.87
Muslim	1.63	3.91	6.43		1.59	3.87	6.06
Eta	.19	.16	.12	Beta	.07	.09	.05
Ethnicity							
Amhara	1.65	3.60	5.48		1.44	3.63	5.64
Oromo	1.67	3.73	6.02		1.58	3.62	5.70
Gurage	1.60	3.89	6.27		1.53	4.20	6.45
Kamb. & Had.	1.46	3.74	6.25		1.50	4.32	6.54
Eta	.18	.03	.12	Beta	.04	.09	.12
Age at marriage							
< 15	1.92	4.19	6.00		1.97	4.22	6.03
15 - 17	1.53	3.86	5.93		1.60	3.92	5.99
18 or more	0.91	3.22	5.69		0.57	3.04	5.50
Eta	.26	.17	.04	Beta	.37	.22	.07
Marital Stability							
Stable	1.56	4.09	6.65		1.59	4.03	6.45
Not stable	1.40	3.28	5.11		1.32	3.37	5.32
Eta	.06	.19	.26	Beta	.10	.16	.20
Approval of FP							
Yes	1.86	4.05	6.61		1.69	3.88	6.52
No	1.38	3.62	5.61		1.45	3.72	6.15
Eta	.18	.10	.16	Beta	.09	.04	.02
Grand mean	1.52	3.78	5.90				
N	633	1119	1240				
R squared	.18	.17	.18		.43	.46	.24

Region and Fertility

Fertility appears to be higher in Arsi than in Shoa. The total fertility rate computed from the number of births in the last 12 months before the survey was 9.3 children per woman in Arsi and 6.7 in Shoa while the total marital fertility was 11.2 in Arsi and 8.4 in Shoa. Also mean number of children ever born to women aged 45-49 years was 7.04 in Arsi and 5.53 in Shoa.

From Table 6.3, it may be seen that the gross average for Arsi was 5.02 and that for Shoa was 4.16 and when age and other predictors are controlled, the average number of births in Arsi was 4.81 while that in Shoa was 4.20. Similar patterns may also be observed from Table 6.4. Both unadjusted and adjusted means are higher in Arsi than in Shoa for each of the age group 15-24, 25-34 and 35-49. Nevertheless, the unadjusted differences are smaller for women in the young and middle ages of childbearing and are much pronounced for those nearing the end of childbearing. However, differences are slightly reduced when age and other factors are controlled for. This indicates that some of the regional fertility differential is explained by differences in factors that indirectly or directly affect fertility such as religious beliefs, ethnicity, age at marriage and marital stability among others. However, significant differences are still present when these factors are held constant suggesting that there are other factors not included in the models that may explain some of the remaining differential in the number of children ever born in the two regions.

One such factor is infant/child mortality. Infant/child mortality is substantially higher in Arsi than in Shoa. For instance Mammo (1988) estimated $_1q_0$ as 169 and 105 per 1000 live births respectively for Arsi and Shoa in 1980. He did not make any estimate of $_5q_0$ for 1980 but for 1975, he estimated it as 246 and 200 per 1000 respectively for Arsi and Shoa. This shows that a baby born in Arsi had about 1.60 times higher risk of dying before the first birthday and 1.23 times higher risk of dying before the fifth birthday than that born in Shoa. In populations where children are breastfed for longer durations, the physiological effect of infant mortality is that breastfeeding is discontinued and ovulation is expected to be resumed sooner so that in the absence of contraception, an earlier pregnancy is anticipated, other things being equal. Therefore, women who experience infant deaths are likely to have shorter inter-birth intervals and consequently, higher completed family size. Infant/child mortality may also affect fertility levels by operating through anticipation of prospective high child mortality.

Residence and fertility

Urban environment being the nucleus of social change in developing countries, it provides women with greater access to education and employment outside the traditional sector. It restricts them less to traditional kinship norms and makes contraceptive information more readily available (Curtin, 1982). Moreover, urban environment exposes them to consumption goods and lifestyles alternative to bearing and rearing children (Mason and Palan, 1981). Consequently, urban fertility is known to be lower than rural fertility. However, absence of significant differences in urban-rural fertility have been found in many countries. For example, in Cameroon and Nigeria in Africa, in Indonesia, Jordan, and Pakistan in Asia and in Guyana in Latin America, WFS findings indicate that TFR was slightly higher in Urban areas than in rural areas (Ashurst, et al 1984).

As in most of the other regions of the country, rural and urban areas in Central Ethiopia are quite different in their characteristics. Rural areas are characterised by lower levels of literacy, the household economy is based on subsistence agriculture and traditional family norms are much stronger. In urban areas on the other hand, literacy is relatively higher, traditional family size norms are less dominant and the household economy is based on wage earning or small scale business. As a result, in the rural areas, children and women play a much greater role in the household economy than they do in the urban areas. Hence fertility is expected to differ between urban and rural areas.

Mean number of children ever born by women aged 45-49 was 6.7 and 5.5 respectively for rural and urban areas. TFR was computed as 7.9 for rural areas and 5.8 for urban areas while the TMFRs were respectively 9.11 and 8.10 for rural and urban areas. All these measure suggest that there is a fertility differential between rural and urban areas.

From the unadjusted and adjusted means of the MCA for all ever married women presented in Table 6.3, however, it may be observed that residence does not show a strong association with fertility. Although both gross and net means are higher than the grand mean for rural women than for urban women, the difference is not much. On the other hand, Table 6.4 shows that the residential fertility differential is significant for women in the later years of childbearing and that for those in the younger and middle years of childbearing, the difference in gross terms is very small but increased when age at survey and the other factors are controlled and that for the older women it was reduced. This shows that the rural urban fertility differential clearly emerges in later years of childbearing and it may indicate lifestyle effects.

Literacy and Fertility

Although the overall level of literacy appears to be low in this population, there seems to be some difference in fertility between literate and illiterate women. The reported fertility appears to be lower for literate women than for illiterate women. For instance, mean number of children ever born by women aged 45-49 was 5.7 and 6.3 respectively for literate and illiterate women. TFR was 6.3 for literate women and 7.8 for illiterate while TMFR was 7.4 for literate and 8.9 for illiterate women in Central Ethiopia in 1986. These measures of fertility indicate that literate fertility was at least 10 per cent lower than that for the illiterate.

The results of the MCA technique for ever married women aged 15-49 years presented in Table 6.3 also shows that in gross terms, literate women on average had about 15 per cent fewer mean births than illiterate women. When the effect of age and other predictors, region, residence, religion, ethnicity, age at marriage, marital disruption and family planning approval were controlled, the net effect of literacy on the number of births was that literate women had about 12 per cent fewer births than the illiterate on average. However, slightly different results were noted when the analyses was carried separately for the three age groups 15-24, 25-34 and 35-49. The inverse relationship between literacy and the number of births shown above was not uniformly observed in all age groups (see Table 6.4). For young women (i.e., those aged 15-24), literacy did not appear to have any effect. Gross means were the same for both literate and illiterate. Women who were at about the middle of their reproductive years also did not show substantial differences but the slight difference was maintained even when age and other factors were controlled. For older women (i.e., 35-49), however, the literate - illiterate difference in the number of births was considerable. In gross terms, the mean number of births for literate women aged 35 years and over was 10.7 per cent lower than that of the illiterate and when the effects of age and other predictors were taken into account, the difference was slightly smaller with literate women having about 9.2 per cent lower births than their illiterate counterparts.

In conclusion, it may be stated that due to the very low level of literacy and also that most of those who are literate had probably not attended formal school but attained their literacy through the National Literacy Campaign that has been in operation since 1979, the literacy and fertility relation appears to be weak. This is in agreement with the suggestion that although the transition from illiteracy to literacy usually depresses fertility, the most substantial reduction often comes with the increase from elementary schooling to secondary and above (Cochrane, 1979; Teinda 1984).

Religion and Fertility

Although the moral philosophy of all major religions promote pro-natal ideology in fairly similar manner in all human populations, significant religious fertility differentials have been documented in a large number of countries. For instance, many studies conclude that muslim fertility is substantially lower than non-muslim fertility. Mabogunje (1972) and Sembajwe (1980) in Nigeria, Gaisie (1975), Page (1975), Podlewski (1975) and more recently Tawiah (1984) in Ghana all report that muslim fertility is lower than non-muslim fertility. However, exceptions to this pattern have also been documented. Belily and Weller (1987) in Sierra Leone and Rizk (1963) in rural Egypt discovered no significant muslim non-muslim fertility differentials while still many others show substantially higher muslim than non-muslim fertility. For instance, Kirk (1967) in Malaysia, Albania and Yugoslavia, Rizk (1973) in Jordan, Matras (1973) in Israel, Mazur (1967) in the Soviet Union and Ahmed (1980) in Bangladesh all found that muslim fertility was higher than that of non-muslim.

In Ethiopia, although studies of the relationship between religion and fertility are scanty, findings are mixed. Ketema, (1985) in her analysis of the National Sample Survey First Round (1970) data failed to find any differentials in child-woman ratio and religion while Sileshi (1985) using the 1981 Rural Demographic Survey data showed that among rural women in Arsi region, muslim women had higher number of births than christian women.

The results obtained from the MCA applied to all ever married women (Table 6.3) show that both gross and net means in the number of children are higher for muslim women than for christian women. This is also true when ever married women are considered by age group although the effect is much stronger for women in the young and middle reproductive years than for the older women. Also, adjusting for age and other factors substantially reduced the effect of religion on number of children ever born in the stratified analysis while in the case of all women, the differences remained intact even after adjusting for the effects of age and other factors.

Ethnicity and Fertility

Ethnicity in association with other variables is an important factor that affects fertility in many countries. For instance, in Kenya, significant differences in the mean number of children ever born was observed between the Hamitic and Bantu; in Zambia, the Nkoya had about 60 per cent of the fertility of the Tambuka and in Tanzania, the mean parity of women aged 40-49 among the Somba was 6.6 against 4.1 for the Ha (ECA, 1979).

Ethnic groups differ in their religious beliefs, in family size norms, in level of literacy, in their age at first marriage as well as in many other factors and consequently fertility tends to differ from one ethnic group to the other.

From Table 6.3, it may be seen that the average number of children born to Amhara women was 3.3 per cent lower than the sample average and that of the Oromo women was about the same as the sample mean. The Gurage and Kambatana Hadiya, on the other hand, had about 3.0 per cent and 5.1 per cent respectively higher average births than the sample mean. When the covariate age and the other predictor variables are controlled, the Amhara and Oromo women had about the same average births as the sample mean while the Gurage and Kambatana Hadiya ethnic groups had respectively 6.3 per cent and 11.2 per cent higher average births than the sample mean.

Separate analysis for each of the three age groups (15-24, 25-34 and 35-49), however gives slightly different results. Both unadjusted and adjusted means were nearly identical for each of the four ethnic groups in the young childbearing years. In the middle childbearing years however, unadjusted means were identical but adjusted means were different. While Amhara and Oromo women had 4.0 per cent fewer births than the sample mean, the other two ethnic groups had more than 10 per cent higher mean births than the sample mean. Among women nearing the end of their reproductive years, average number of births was least for the Amhara (7.0 per cent fewer births than the sample mean) and highest for Gurage and Kambatana Hadiya women (6.0 per cent higher births than the sample mean) and the Oromo in between with about the same number of births as the sample mean. When adjusted however, the results were similar to the earlier ones with two groups - Amhara/Oromo in one group with slightly lower mean births than the sample mean and Gurage/Kambatana Hadiya in the other with higher average births than the sample mean.

In general, the analysis shows that there is no significant difference in fertility between Amhara and Oromo ethnic groups. There is also no significant fertility difference between the Gurage and Kambatana Hadiya ethnic groups but the fertility of the latter groups is significantly higher than that of the Amhara/Oromo fertility (see Table 6.4). The higher and identical Gurage/Kambatana Hadiya fertility is expected because these two ethnic groups live in the same cultural zone (the Enset Culture Zone - an area covering parts of southern Shoa, Northern and Northwestern Sidamo, and parts of Gamo Goffa and Keffa regions where Enset (false banana) is grown and used as a staple food) and have very many things in common. They experience less marriage breakdown and remarriage takes place within a short period after the dissolution of the previous marriage. Also, infant and child mortality appears to be higher for these group of women than women in the other ethnic groups (see Table 6.5). Consequently, the apparently higher fertility of these ethnic groups compared to the Amhara and Oromo may partly be due to their higher level of infant/child mortality and a relatively stable marriage.

Table 6.5 : Estimates of ${}_1q_0$ and ${}_4q_1$ by Ethnic Groups.

	Amhara	Oromo	Gurage	Kambatana Hadiya
${}_1q_0$	124	133	150	155
${}_4q_1$	48	55	87	90

Age at Marriage and Fertility

In traditional societies like Ethiopia where chastity is important, marriage initiates sexual relations and the age at which it starts has an important bearing on the reproductive behaviour of women. The age at which a woman gives birth to her first child, the nature and pattern of her subsequent reproductive events as well as her complete family size depends to a large extent on the age at which first marriage takes place. Women who start married life at younger ages also start childbearing at younger ages and their aggregate fertility tends to be high. Moreover, early marriers may achieve desired family size while at younger ages and may be exposed to the risk of unwanted births for a longer period. On the other hand, those who marry late will have their first birth at later age and they have a shorter period of exposure. As a result, their aggregate fertility tends to be lower.

In Table 6.3, we see that there is a negative relationship between age at marriage and number of births. Women who married before they were 15 years old had higher number of births on the average than those who married later. The difference in average births between women who married while under 15 and those who married at 18 or older is larger than that between those who married while under 15 years of age and those between 15 and 17. Adjusting for age at survey and other factors has slightly increased the effect of age at first marriage on number of children ever born.

The separate analysis of women in the young, middle and later years of reproductive life presented in Table 6.4, on the other hand, shows that for women in the young and middle reproductive years, as would be expected, age at first marriage is strongly related to number of births but for those in the later reproductive years, it is weakly related. For instance, the gross difference in mean number of births between women who married before they were 15 years old and those who married at age 18 years or over was about one child for younger and middle aged women while for the older women, the difference was less than one third of a child. When the effects of age and other factors are controlled, age at marriage appears to have a significantly increased effect on the number of births. However, difference between the two early marriers (that is, the under 15 and 15-17) remained small. The large difference in mean births between those who married before age 15 and those at age 18 or older among women in the young reproductive years (those in the 15-24) may be due to incomplete exposure by those who married after age 18 or later.

Marital Disruption and Fertility

In populations where child birth is confined to married life, women who experience at least one marriage breakdown have smaller completed family size than those who remain in a stable union throughout their childbearing years. However, the difference in completed family size is a function of the time spent between a marriage breakdown and a subsequent remarriage. If remarriage takes place shortly after the dissolution of the previous marriage, the difference in the number of births between the two groups of women may be small, other things being equal. On the other hand, if a considerable time is spent before remarriage, then the difference tends to be large. It must also be noted that in some cultures, remarriage after a marriage dissolution, especially after widowhood, is not allowed. In such cultures, the difference in completed family size between women who remained in stable union and those who did not tends to be large.

It was pointed out earlier (see Chapter Two) that in Ethiopia, marriage dissolution is common. There is however, a considerable variation in the proportion of divorced or widowed women by residence, religion and ethnicity (see Figures 6.1 through 6.7). Although most of the divorced or widowed women remarry, the proportion of reproductive time spent out of wedlock may also vary by residence, religion and ethnicity. As a result, it may be expected that fertility will be lower for women with one or more marital breakdowns than those in stable union. However, the difference in the mean number of births between women in stable union and those with the experience of one or more marital breakdowns was marginal (0.23) in gross terms but increased nearly to one child (0.90) when the effects of age and other predictors are controlled (see Table 6.3).

When the effect of marital stability on number of births is separately examined for each of the three age groups, although it has a significant effect in each case, its effect is substantially increased with age (see Table 6.4). Women in middle and later reproductive years who had experienced one or more marriage breakdowns had a substantially lower number of births. Unadjusted difference were 0.81 children for women aged 25-34 and 1.54 for women nearing the end of their reproductive life. Controlling for age and other factors slightly reduced the effect of marital disruption on number of births. This shows that as expected, marital disruption has a strong negative effect at older ages than at younger ages, perhaps because older women experienced more marriage breakdowns compared to the younger ones. Although remarriage takes place shortly after a marriage breakdown,(i.e., in about three months in case of a divorce and in about a year in case of a widowhood), the results indicate that in general, fertility is lower for women who experience at least one marriage breakdown compared to those who did not. Earlier, it was suggested that infertility is one of the major factors leading to a marriage breakdown (see Chapter Two). As information is not available on the reasons for a marriage breakdown or on the number of times a marriage is broken, it is not possible to show whether the lower fertility of those with the experience of a marriage breakdown is due to infertility or due to loss of a substantial portion of the reproductive years resulting from several marital breakdowns.

Approval of Family Planning and Fertility

In any human society, women approve of family planning perhaps because they are more reproductive compared to those who do not and therefore they either need to space their births, or they had already achieved their desired family size and may want to prevent additional births by using birth control methods. This seems true in Central Ethiopia as well. Approval of family planning is strongly and positively associated with number of births. Women who approved of family planning had a substantially larger number of children than those who did not. In the case of all ever married women, women who approved of family planning had 0.62 more children than those who did not in gross terms and when adjusted for age and other factors, they had nearly one child more than those who did not.

When each of the three age groups are separately examined, the gross difference between those who approved and those who did not was about 0.45 children for women in the young and middle reproductive years, and for those in the late years it was one child. When age and other factors were held constant, although there was a substantial reduction of the difference in means, women who approved of family planning still had higher means than those who did not approve. In short, the analysis clearly shows that there is need for family planning in Central Ethiopia. However, practice appears to be absent perhaps because family planning services are not available within the reach of the people.

6.3. Urban Fertility Differentials

Table 6.6 illustrates the relationship between children ever born to urban women aged 15-49 years and the background socio-economic and demographic variables while Table 6.7 presents the same relationship for women in the three broad age groups 15-24, 25-34 and 35-49.

From Table 6.6, it may be seen that both the unadjusted and adjusted means are higher in Arsi than in Shoa indicating that urban women in Arsi had higher fertility than urban women in Shoa. However, the difference is larger for older women than for younger ones and when age and other predictors are adjusted, the differential is substantially reduced. Table 6.6 also shows that, although literate women appeared to have lower average number of children initially, when age and other variables are controlled, the effect of literacy is removed. This shows that in urban areas, literacy had no significant effect on fertility when other predictors were controlled.

Religion on the other hand, seems to have a significant effect on fertility. Both the unadjusted and adjusted means were lower for christians than for muslims. Ethnicity also appears to have a significant effect on fertility. Unadjusted means indicate that except the Gurage, all other ethnic groups had about the same number of births. However, when religion, literacy, age at marriage, marital disruption and approval of family planning were controlled, the Kambatana Hadiya had slightly higher number of births than the Gurage. Also the difference in the number of children between the Kambatana Hadiya and the Amhara was about half a child and that between the Kambatana Hadiya and the Oromo was about three quarter of a child. It appears that urban Oromo women had lower fertility than any other ethnic group in Central Ethiopia. Age at first marriage had the largest effect on number of children ever born. The difference between the unadjusted and adjusted means were negligible indicating that age at marriage had a strong effect on fertility even after the effects of age and other predictor variables were controlled for.

The relationship between number of births and marital disruption is such that women in stable union had larger number of births. Controlling for age, age at marriage and the other predictors, literacy, religion and ethnicity substantially increased the effect of marital disruption on number of births. For instance, women in stable union had about 0.40 children more than those with at least one marriage dissolution but when age and other factors were controlled, the difference increased by nearly one child to 1.30 indicating a very strong effect of marital disruption on fertility. Like all previous results, approval of family planning was positively associated with fertility. Both the unadjusted and adjusted means show that women who approved family planning had larger number of births than those who did not.

In general, the table shows that early marrying women, illiterate women, muslim women and Kambatana Hadiya and Gurage women in urban areas appear to have higher fertility. From the eta values, it can be observed that age at marriage is more closely associated with the number of children ever born than any other predictor variable included in the analyses and that the beta values show that when other explanatory variables are controlled, marital disruption is associated to fertility more than all other predictors. Note that the beta values for age at marriage and approval of family planning were the same though the direction of the relationship was different. The proportion of total variance in the number of births explained by the MCA model in this case is about 32 per cent.

Table 6.6 : Unadjusted and Adjusted Mean Number of Children Ever Born by Ever Married Urban Women Aged 15-49.

Background variables	unadjusted	Eta	Adjusted	Beta
Region				
Arsi	4.96		4.59	
Shoa	4.08	.11	4.14	.06
Literacy				
Literate	4.00		4.21	
Illiterate	4.14	.08	4.21	.00
Religion				
Christian	4.14		4.15	
Muslim	4.65	.06	4.69	.06
Ethnicity				
Amhara	4.16		4.24	
Oromo	4.08		3.95	
Gurage	4.72		4.52	
Kam. + Had.	4.10	.07	4.69	.08
Age at marriage				
< 15	4.53		4.54	
15 -17	4.34		4.38	
18 or more	3.29	.16	3.16	.18
Marital stability				
stable	4.43		4.92	
not stable	4.04	.07	3.65	.23
Approval of Fp				
Yes	4.46		4.63	
No	3.85	.11	3.61	.18
Grand mean	4.21			
N	847			
R Squared				.32

When women in each of the three broad age groups (15-24, 25-34 and 35-49) were separately analysed, however, the findings differed from that for the entire childbearing age range presented above and also between the age groups (see Table 6.7). Age at first marriage appeared to be the principal determinant of fertility in young and middle age groups only (i.e., 15-24 and 25-34). Marital disruption, religion and ethnicity had strong effects in the middle and older age groups. Literate women in the young and middle age groups had slightly higher number of children than their illiterate counterparts. For the older women however, literacy had the expected negative relationship with number of births. The slightly higher births for the young and middle aged literate women may in part be due to the fact that these women wanted to achieve a desired family size while still young by spacing their births closer together and avoid childbearing in the later years of their reproductive life by resorting to contraception.

Although muslim women have larger number of births than christians in each of the three age groups, differences are smaller for women in the young and middle age groups. For instance, difference between the gross means is about half a child for women under 34 years of age but for those 35 years and over, it is more than a child. However, when age and other factors are controlled, the differences are substantially reduced.

Table 6.7 : Unadjusted and Adjusted Mean Number of Children Ever Born by Age Group: Ever Married Urban Women.

	Unadjusted means				Adjusted means		
Background		age	groups				
variables	15-24	25-34	35-49		15-24	25-24	25-29
Region							
Arsi	2.13	4.09	6.33		1.89	3.83	6.11
Shoa	1.69	3.74	5.30		1.73	3.78	5.34
Eta	.11	.06	.13	Beta	.04	.01	.09
Literacy							
Literate	1.89	3.88	5.05		1.83	3.82	5.23
Illiter.	1.59	3.68	5.73		1.66	3.75	5.61
Eta	.11	.05	.11	Beta	.07	.02	.06
Religion							
Christ	1.69	3.82	5.40		1.71	3.84	5.48
Muslim	2.11	4.37	6.59		1.98	4.14	5.68
Eta	.11	.20	.16	Beta	.07	.16	.07
Ethnicity							
Amhara	1.70	3.83	5.30		1.68	3.75	5.49
Oromo	1.93	3.57	5.50		1.91	3.39	5.07
Gurage	1.75	4.38	6.57		1.80	3.97	5.98
Kam. + H.	1.58	3.53	4.96		1.63	4.55	5.76
Eta	.09	.12	.14	Beta	.08	.17	.09
Age at marriage							
< 15	2.11	4.24	5.67		2.19	4.14	5.51
15-17	1.78	4.02	5.46		1.83	3.92	5.59
18 or more	1.13	2.61	4.95		0.86	3.00	4.79
Eta	.26	.21	.07	Beta	.35	.19	.09
Marital stabil.							
Stable	1.82	4.22	7.05		1.87	4.11	6.54
not stab.	1.60	3.37	4.83		1.50	3.47	5.03
Eta	.08	.23	.34	Beta	.13	.15	.23
Approval							
Yes	2.06	3.97	6.20		1.93	3.81	5.82
No	1.21	3.46	4.76		2.00	3.75	5.12
Eta	.32	.11	.24	Beta	.18	.01	.12
Grand mean	1.75	3.79	5.46				
N	138	385	324				
R squared	.36	.27	.29		.41	.50	.30

Ethnic differences are also smaller for urban women in the young and middle reproductive years as the unadjusted and adjusted means in table 6.7 indicate. Young Oromo women had higher unadjusted and adjusted means. Kambatana Hadiya women aged 25-34 had the smallest unadjusted mean but when adjusted for age and other factors, they had the highest mean number of births. For the Gurage women in their later years of reproduction, both the adjusted and unadjusted means are higher. The overall effect of ethnicity in urban areas is such that among younger women, the Oromo followed by the Gurage appear to have higher fertility while among those in the middle reproductive years, births are higher for the Kambatana Hadiya followed by the Gurage and among those in the older age group, the Gurage followed by the Kambatana Hadiya have higher births. It may be concluded that when age and other factors are controlled, Oromo fertility is the least followed by that of the Amhara in the 25-34 and 35-49 age groups. The Gurage and the Kambatana Hadiya ethnic groups appear to have about the same level of fertility. However, the results for the Gurage and Kambatana Hadiya women are based on small samples (24 and 18 women) for the young age groups (i.e., 15-24) and therefore, should be treated with caution.

6.4. Rural Fertility Differentials

Table 6.8 presents the results of the MCA on the number of children ever born among ever married rural women in their childbearing ages and the background demographic and socio-economic variables. Like urban women, rural women in Arsi also had higher number of births than those in Shoa. Both adjusted and unadjusted means were much higher in Arsi than in Shoa and that both unadjusted and adjusted means for literate women are substantially lower than for illiterate women. This indicates that unlike urban areas, literacy is negatively related to fertility in rural areas. However, the difference between the adjusted means is smaller than for the unadjusted means implying that controlling for age and other factors reduces the effect of literacy on number of births. Religious differences are modest with christians having about a quarter of a child less than muslims and that controlling for age and other predictors does not reduce the effect of religion on fertility.

Table 6.8 : Unadjusted and Adjusted Mean Number of Children Ever Born to Ever Married Rural Women Aged 15-49.

Background Variables	Unadjusted means	Eta	Adjusted means	Beta
Region				
Arsi	5.03		4.84	
Shoa	4.18	.11	4.22	.08
Literacy				
Literate	3.44		3.62	
Illiterate	4.47	.07	4.44	.10
Religion				
Christian	4.25		4.24	
Muslim	4.49	.04	4.44	.04
Ethnicity				
Amhara	4.17		4.25	
Oromo	4.33		4.26	
Gurage	4.34		4.49	
Kam. + Had.	4.56	.12	4.86	.08
Age at marriage				
< 15	4.68		4.60	
15 - 17	4.27		4.34	
18 or more	4.10	.04	4.02	.07
Marital Stability				
Stable	4.38		4.49	
Not stable	4.23	.12	3.99	.08
Approval of FP				
Yes	4.98		5.13	
No	3.52	.04	4.11	.15
Grand mean	4.33			
N	2145			
R Squared				.20

From the means for ethnic groups presented in Table 6.8, it may be seen that although the Amhara women had lower unadjusted mean number of children than the Oromo women, when age and other factors are adjusted, these two ethnic groups had the same mean. Both the unadjusted and adjusted means for the Kambatana Hadiya women are larger than that for any other ethnic group and the Gurage women had smaller mean than the Kambatana Hadiya women but larger than that of the Amhara or Oromo women.

Age at marriage has an inverse relationship with fertility. The unadjusted difference in the mean number of births between rural women who married before they were 15 years old and those who married at age 18 or over was more than half a child while those who married before age 15 and those who married between age 15 and 17 had about the same means. However, adjusting for age and other factors has slightly reduced the differences. The gross effect of marital stability on rural fertility seems to be small as the difference in the gross means between women in stable union and those with at least one marriage breakdown is very small. Nevertheless, the difference increases to about half a child when age and other predictor variables are taken into account. It appears that the effect of marriage disruption is small in rural areas probably because remarriage takes place quickly after a marital breakdown and that the proportion of the reproductive period lost due to a marriage breakdown is small.

From Table 6.9 below, it may be observed that significant regional difference in the number of births also exists between rural women in Arsi and those in Shoa in all age groups though smaller in the young and middle age groups than in the older age groups. In gross terms, Arsi women nearing the end of their childbearing years had about one child more than their counterparts in Shoa but when age and the other predictors are controlled, the regional differences are reduced substantially. Literacy has a weak but negative relationship to fertility. In gross terms, literate women have smaller number of births than the illiterate ones in all age groups. However, the difference is smaller in the young age group (15-24). When age and the other factors are controlled, the difference in the number of births between literate and illiterate rural women aged 15-24 and 25-34 is reduced by a substantial amount while that for the 35-49 group increased.

Table 6.9 also shows noticeable religious differences in the number of births. Muslim rural women had higher number of births and that the gross difference increased with age of the women. But when the effects of age and other factors are controlled, the differences are reduced for women in the young and old age groups while for those in the middle (25-34), the religious difference remained more or less unchanged.

Although there is no pronounced ethnic difference in the fertility of young rural women in Central Ethiopian except that of the Kambatana Hadiya, among women in the middle and later years of reproduction however, the Amhara and Oromo, on the one hand, had relatively lower fertility while the Gurage and Kambatana Hadiya on the other had higher fertility but when adjusted, the means for these women were about the same as those for the other ethnic groups indicating that the ethnic - fertility differential among young rural women is mainly due to differences in other factors. The smaller number for the Kambatana Hadiya women in the young age groups may be due to the slightly higher age at marriage among these women. (Kambatana Hadiya women both in urban and rural areas marry about 10 months on average later than any other ethnic group.) The gross means for women in the middle age groups differed marginally while for those nearing the end of their reproductive life, differences were larger. While the Oromo and the Gurage had about the same number of births, there is a difference of about one child between the Amhara and the Kambatana Hadiya women. Nevertheless, when adjusted for the effect of other variables, two groups emerged - the Oromo and Amhara with relatively lower means formed group one and the Gurage and Kambatana Hadiya with higher births formed group two.

The large difference in the number of births between the Amhara and Oromo women in the later years of reproduction disappeared when adjusted suggesting that the difference may be due to differences other than in ethnicity but probably in marital disruption. It was shown that the proportion of Amhara women in non-stable union was substantially larger than for any other ethnic group (see Figure 6.5). Note that although younger Kambatana Hadiya women had lower number of births than that for other ethnic groups, those in the middle and older age groups had higher mean number of births compared to that of the other ethnic groups. This is perhaps due to other factors such as shorter length of time between marriage breakdown and remarriages, shorter durations of breastfeeding probably due to higher infant and child deaths, among other things. But lack of information prevents the consideration of these factors. Age at marriage has a very strong impact on the fertility of rural women under 35 years of age. For those nearing the end of reproductive life however, its effect is small. Examination of the unadjusted means shows that among women in the young and middle child bearing years, those who married before they were 15 years of age had on average one child more than those who married at 18 or older. Among those in the later years of childbearing, those who married while under 15 years of age had about a quarter of a child more than those who married at 18 or over. Similarly, for women aged under 35, the number of births between those who married while between 15 and 17 years of age and those at 18 years or older differed by 0.6 children on average. The difference is much smaller for the older women. Note that the difference in the number of births between women marrying while under 15 years of age and those between 15 and 17 is much smaller compared to those marrying while under 15 and those at 18 years of age or older. From the adjusted means, it may be observed that the effect of age at marriage increases for each age group of women when other factors are controlled.

Like women in urban areas, for rural women also, marriage disruption has an inverse relationship with fertility and its effect increases with age. Among those in the middle of the childbearing span, women in stable union had on average 0.81

children more and those in the later years had 1.54 more children in gross terms than their counterparts who had experienced one or more marriage breakdowns. Although adjusting for age and other predictors reduced the effect of marital disruption on number of births, differences remained substantial.

Table 6.9 : Unadjusted and Adjusted Mean Number of Children Ever Born by Age Group: Ever Married Rural Women.

	Unadjusted means				Adjusted means		
Background				age groups			
variables	15-24	25-34	35-49		15-24	25-34	35-49
Region							
Arsi	1.63	4.06	6.89		1.71	3.81	6.33
Shoa	1.49	3.72	5.85		1.47	3.76	5.98
Eta	.05	.07	.14	Beta	.07	.01	.05
Literacy							
Literate	1.37	3.37	5.86		1.43	3.55	5.71
Illiter	1.55	3.84	6.07		1.52	3.81	6.08
Eta	.06	.09	.02	Beta	.01	.05	.04
Religion							
Christ	1.46	3.69	5.89		1.49	3.65	5.99
Muslim	1.57	4.13	6.41		1.55	4.03	6.18
Eta	.04	.15	.09	Beta	..04	.09	.03
Ethnicity							
Amhara	1.60	3.75	5.45		1.47	3.67	5.60
Oromo	1.62	3.78	6.12		1.55	3.67	5.60
Gurage	1.56	3.70	6.20		1.53	3.88	6.44
Kam.+ H.	1.20	3.84	6.52		1.49	4.00	6.70
Eta	.06	.11	.14	Beta	.04	.07	.13
Age at marriage							
< 15	1.90	4.15	6.12		1.91	4.24	6.19
15-17	1.52	3.84	6.12		1.60	3.92	6.14
18 or more	0.87	3.32	5.83		0.53	3.06	5.70
Eta	.26	.15	.04	Beta	.38	.23	.07
Marital Stability							
stable	1.56	4.09	6.65		1.59	4.03	6.45
not stable	1.40	3.28	5.11		1.32	3.37	5.32
Eta	.01	.18	.22	Beta	.06	.15	.17
Approval of FP							
Yes	1.78	4.16	6.92		1.57	3.96	6.74
no	1.45	3.66	5.81		1.49	3.72	5.86
Eta	.11	.11	.16	Beta	.03	.05	.13
Grand mean	1.51	3.77	6.05				
N	491	738	916				
R squared	0.121	0.131	0.143		0.443	0.383	0.224

Similar to all other models so far considered, approval of family planning is positively related to fertility. The results of both gross and net effects show that rural women who approved of family planning had higher births than those who did not in all age groups.

From the values of eta and beta, it appears that marriage disruption is more associated with fertility than any other variable in the model for rural women in the early and later years of reproduction. Age at marriage and religion come next to marital disruption in the middle years of reproduction.

6.5. Within Ethnic Fertility Differentials

The preceding three sections examined fertility differentials for the total ever married women, urban ever married women and rural ever married women. In this section we examine the within ethnic group differential in fertility. Like in the earlier sections, we consider ever married women aged 15-49 in each of the four ethnic groups and also ever married women in the age groups 15-24, 25-34 and 35-49 for the Amhara and Oromo ethnic groups only as the sample size is too small to enable a similar analyses for the Gurage and Kambatana Hadiya women. The stratified analysis pursued here is in order to see whether the findings of the previous sections remain valid for each of the ethnic groups included in the sample.

Amhara Ethnic Group

Nearly 30 per cent of the ever married women in the sample were reported as belonging to the Amhara ethnic group which is the second largest in the country next to the Oromo. Although the Amhara are homogeneous in that over 97 per cent of the women in the sample belonged to the Ethiopian Orthodox Church, they are heterogeneous in many aspects such as in literacy, residence and the like. For instance, nearly 30 per cent of the ever married women were urban residents, 51 per cent were literate and about 40 per cent of them approved the use of family planning. There are also noticeable differences in the age at first marriage. More than a quarter of the woman married while they were under 15 years of age, 55 per cent between 15 and 17 years and 17 per cent married at 18 years of age or older. Marriage disruption appears to be most common among the Amhara than among women in any other ethnic group. Only 39.0 per cent of the ever married women were in their first union at the time of the survey (see Tables 6.1 and 6.2).

They also show marked differences in the number of children they had borne according to their background characteristics. Table 6.10 presents the relationship between the number of children ever born by ever married Amhara women in their reproductive years and the six selected variables, residence, literacy and religion, age at first marriage, marital breakdown and approval of family planning.

Amhara women in Arsi had about one child more than those in Shoa in gross terms. But when age and other factors are taken into account, the difference in means is reduced by about 50 per cent. Residence has a weak relationship to the number of births. Unadjusted means were about the same for both rural and urban residents but when adjusted, urban women had on the average about a quarter of a child fewer births than rural women. Literacy also has a weak relationship to number of births. The unadjusted means between literate and illiterate women differed by nearly a third of a child with literate women having fewer births than the illiterate women but when age and other factors were controlled, the difference is reduced by 50 per cent. Similarly, christians had about a third of a child fewer births than muslims and adjusting for age and other predictors narrowed the difference. However, this should be taken with care as the number of muslim women among the Amhara were very few (only 26 women).

Age at first marriage is inversely related to number of births. Amhara women who married before their 15th birthday had 0.63 births more on average than those who married at age 18 or over. When the effect of age and all the other factors is controlled, the effect of age at first marriage increased giving a beta value of 0.14. Women marrying before age 15 had about the same number of births as those marrying between 15 and 17 years but 1.05 births more than those marrying at age 18 or over when the covariate age and all the predictor variables are held constant. This shows that the effect of age at first marriage is marginal for those women marrying before age 18 and substantial for those marrying at 18 or over.

Marriage breakdown also shows a strong negative relationship to the number of children ever born. women with no experience of marriage dissolution have larger number of children than those with at least one marriage dissolution.

When the effects of age and other explanatory variables are taken care of, a woman in a stable union had on average 1.22 births larger than another woman who was not.

Approval of family planning also appears to have a similar but opposite effect on the number of births as that of marriage disruption. The unadjusted difference in the number of births between women who approved of family planning and those who did not is a little less than one child but when adjusted for age and other variables, the difference increases to more than a child. Both the unadjusted and adjusted means show that women who approved of family planning were those with higher number of births.

Table 6.10: Unadjusted and Adjusted Mean Number of Children Ever Born by Amhara Ever Married Women Aged 15-49.

Background variables	Unadjusted mean	Eta	Adjusted mean	Beta
Region				
Arsi	4.95		4.53	
Shoa	3.98	.15	4.00	.08
Residence				
Rural	4.17		4.28	
Urban	4.15	.00	4.03	.05
Literacy				
Literate	3.93		4.07	
Illiterate	4.26	.06	4.20	.02
Religion				
Christian	4.15		4.16	
Muslim	4.48	.02	4.30	.02
Age at marriage				
< 15	4.33		4.39	
15 - 17	4.22		4.30	
18 or more	3.70	.08	3.34	.14
Marital stability				
Stable	4.40		4.90	
Not stable	4.00	.07	3.68	.22
Approval of FP				
Yes	4.70		4.87	
No	3.77	.17	3.65	.20
Grand Mean	4.16			
N	813			
R Squared			.43	

The relationship between number of births and the socio-economic and demographic variables by age group presented in Table 6.11 below shows that there is a pronounced regional difference in the number of births in all age groups. Although Amhara women in Arsi appeared to have higher births than those in Shoa in all age groups, differences are larger for women nearing the end of their reproductive years. Also difference between gross means is larger than the difference between net means suggesting that most of the regional differentials within the Amhara women are due to factors other than region. Residence and literacy however, do not show large gross or net differences in the number of children in all age groups. Although the gross mean is higher for literate women than for illiterate women, the adjusted mean is smaller. (Note that religion is not included in this analysis because over 97 per cent of the Amhara women were christians.) Age at marriage exerts a significant effect on women in the young and middle reproductive years and marital disruption on women in the middle and later years of reproduction (see Table 6.11). Adjusting for the effect of age and other factors appears to have increased the effects of both factors for women in the young age group.

Table 6.11: Unadjusted and Adjusted Mean Number of Children Ever Born by Age Group: Ever Married Amhara Women.

	Unadjusted mean				Adjusted mean		
Background	age groups						
variables	15-24	25-34	35-49		15-24	25-34	35-49
Region							
Arsi	1.96	4.04	6.61		1.86	3.80	5.96
Shoa	1.57	3.74	5.08		1.59	3.64	5.24
Eta	.12	.06	.20	Beta	.08	.03	.09
Residence							
Rural	1.60	3.75	5.45		1.78	3.83	5.37
urban	1.70	3.83	5.30		1.47	3.76	5.40
Eta	.04	.02	.02	Beta	.12	.02	.01
Literacy							
Literate	1.70	3.82	5.11		1.77	3.75	5.12
Illiter	1.60	3.77	5.48		1.57	3.81	5.48
Eta	.04	.01	.05	Beta	.08	.02	.05
Age at marr.							
< 15	1.81	4.00	5.38		1.83	4.11	5.46
15 - 17	1.61	3.92	5.61		1.67	3.88	5.58
18 or more	1.33	3.23	4.66		1.46	3.52	4.54
Eta	.16	.15	.11	Beta	.20	.17	.11
Marital stab.							
stable	1.68	4.18	6.96		1.75	4.12	6.37
not stabl	1.57	3.47	4.80		1.46	3.52	5.01
Eta	.04	.18	.32	Beta	.11	.15	.20
Approval of FP							
Yes	2.07	4.10	6.50		1.83	3.80	6.08
No	1.33	3.49	4.75		1.50	3.78	4.99
Eta	.29	.16	.28		.13	.01	.17
Grand mean	1.64	3.79	5.38				
N	135	306	372				
R squared	0.30	0.21	0.25		0.38	0.38	0.35

To sum up, differences remain even when age and other explanatory variables are controlled indicating that there are other variables not included in the model that explain the differentials in the number of children ever born among Amhara women. However, from the eta and beta values presented in the table, it may be concluded that marital disruption and age at first marriage have strong negative effect on the number of births than other predictor variables and that residence, literacy and religion have modest effects.

Oromo ethnic group

Unlike the Amhara, most of the oromo women in the sample were illiterate and rural residents (20 per cent literate and 19 per cent urban). About 26 per cent of them married before age 15, 52 per cent between 15 and 17 and 22 per cent married at age 18 or older (see Figure 6.10). Marriage appears more stable for the Oromo women as nearly two third of the ever married women were in stable union at the time of the survey. The proportion of christians is much lower when compared to that of the Amhara (71 per cent against 97 per cent) but compared to other ethnic groups, it is high. Only 37 per cent of the ever married women approved family planning - much lower than that obtained for the Amhara ever married women.

The average number of births to ever married Oromo woman of reproductive age is 4.3. However, like the Amhara women, they also show variations by region, residence, literacy, religion, age at marriage, marital stability and approval of family planning. Table 6.12 presents the gross and net means obtained from the MCA model applied to ever married Oromo women aged 15-49. Here again, Arsi has higher mean number of children than Shoa. The gross difference is about one child but when the effects of age and other factors are controlled, the difference is reduced to a large extent. Residence has modest effect on number of births before and after adjusting for age and other variables. Urban women had about a quarter of a birth less than their rural counterparts. The effect of residence on number of births does not change when the effects of age and other factors are held constant. Literacy on the other hand appears to have a very strong effect on the number of births. The gross effect of literacy is that literate Oromo women had on average about one child more than illiterate Oromo women. However, controlling for age and the other factors reduced the effect of literacy substantially. The high eta value for literacy compared to other predictors indicates that literacy is more associated with number of births than any other predictor variable in the model. However, when age and the other predictors are held constant, literacy loses its effect as a major determinant of the number of births. The eta value for religion is next highest to literacy and indicates that religion is the next important determinant of births. From the gross effects, it my be seen that muslim women had on average about two third of a child more births than christian women but when age and other variables are controlled, they had just over a third of a child more births.

At the gross level, women marrying before age 15 had about a third of a birth more than those marrying between 15 and 17 years of age and a little more than two third of a birth more than those marrying at age 18 years or over. Controlling for age and the other variables reduced the difference between the early marriers (those marrying before age 15 and those between 15 and 17) while increasing that between those marrying before 18 and those at 18 years or older.

Marriage breakdown is negatively but weakly related to the number of births but its effect increased when controlled for age and other variables giving a net difference of nearly one birth between women in stable union and those who were not. From the beta values, it appears that marriage disruption is the single most important variable affecting differentials in the number of births after controlling for the effect of the other variables.

Table 6.12: Unadjusted and Adjusted Mean Number of Children Ever Born by Oromo Women Aged 15-49.

Background variable	Unadjusted means	Eta	Adjusted means	Beta
Region				
Arsi	5.02		4.55	
Shoa	4.02	.14	4.19	.05
Residence				
Rural	4.33		4.33	
Urban	4.08	.03	4.08	.03
Literacy				
Literate	3.42		3.94	
Illiterate	4.49	.15	4.36	.06
Religion				
Christian	4.09		4.17	
Muslim	4.49	.11	4.55	.06
Age at marriage				
< 15	4.60		4.55	
15 - 17	4.27		4.37	
18 or more	3.92	.08	3.76	.10
Marital stability				
stable	4.39		4.61	
not stable	4.07	.10	3.69	.15
Approval of Fp				
Yes	4.33		4.33	
No	4.08	.10	4.08	.10
Grand mean	4.28			
N	1227			
R squared				.39

The gross effect of approval of family planning is that women who approved of family planning had more than half a birth higher than those who did not and when other factors and age are controlled, the difference increases to more than three quarter of a child.

The relationship between number of births and background socio-economic and demographic variables presented in Table 6.13 also shows differences in the number of births. Region and literacy have smaller effects for younger women than for older ones. Although both gross and net means are higher for women in Arsi and for illiterate women, differences are narrower when age and other predictors are adjusted. Although the gross mean was higher for rural women than for urban women in all age groups, the net mean was the same for rural and urban young women and for those in the middle and later childbearing years, the differences were smaller. Mean number of births are higher for muslim than for christian women but again older muslim women appear to have substantially larger number of births than older christian women. However, controlling for the effect of age and other factors reduces the difference in means considerably.

The effect of age at marriage on number of births, on the other hand, appears to fall with increasing age of woman. Note that though the gross mean between women who married before age 15 was higher than that for women who married between 15 and 17 years of age, the net mean was smaller probably due to adolescent subfecundity. Unlike age at first marriage, the effect of marital disruption increased with increasing age of women. Unadjusted difference in mean number of children between women in stable union and those with one or more marriage breakdown increased with increasing age. When the effects of age and other predictors are controlled, the differences are reduced for women aged 25 years and over but increased for younger women.

Table 6.13: Unadjusted and Adjusted Mean Number of Children Ever Born by Age Group: Ever Married Oromo Women.

Background variables	Unadjusted means				adjusted means		
	age groups						
	15-24	25-34	35-49		15-24	25-34	35-49
Region							
Arsi	1.69	4.14	6.84		1.71	3.88	6.04
Shoa	1.65	3.58	5.66		1.64	3.67	6.00
Eta	.01	.12	.18	Beta	.02	.05	.01
Residence							
Rural	1.62	3.77	6.11		1.66	3.80	6.06
Urban	1.93	3.56	5.50		1.66	3.49	5.78
Eta	.08	.05	.08	Beta	.00	.07	.03
Literacy							
Literate	1.67	3.44	4.98		1.70	3.55	5.46
Illiterate	1.66	3.81	6.17		1.65	3.77	6.10
Eta	.00	.08	.14		.02	.05	.07
Religion							
Christian	1.60	3.63	5.69		1.60	3.67	5.84
Muslim	1.83	3.92	6.79		1.83	3.74	6.40
Eta	.08	.07	.17		.08	.03	.09
Age at marriage							
< 15	2.20	4.02	6.16		2.23	4.04	6.03
15 - 17	1.67	3.75	6.06		1.75	3.95	6.14
18 or more	0.82	3.34	5.70		0.48	2.99	5.68
Eta	.34	.12	.06		.44	.22	.06
Marital Stability							
Stable	1.68	4.02	6.56		1.75	3.94	6.46
Not stable	1.59	3.19	5.27		1.13	3.33	5.40
Eta	.03	.20	.22		.14	.15	.18
Approval of FP							
Yes	1.97	3.98	6.50		1.78	3.82	6.31
No	1.53	3.52	5.75		1.61	3.64	5.85
Eta	.15	.11	.12		.06	.04	.07
Grand mean	1.66	3.72	6.01				
N	258	450	518				
R Square	.18	.12	.17		.45	.41	.25

The foregoing shows that for all ever married Oromo women taken together, literacy and religion appear to be the two important socio-economic determinants of the number of births and age at marriage appears to be less important compared to marital stability (Table 6.12). When the analysis was carried out separately by broad age groups (Table 6.13), age at first marriage emerges as an important demographic determinant of number of births among the younger women and less important among the older women as the eta and beta values indicate. However, part of the high eta and beta values for the younger women may be due to the effect of smaller sample size as there were only 258 ever married Oromo women aged under 25 years and these were divided into three categories of age at first marriage (under 15, 15-17 and 18 years and over). The effect of marital stability increased with increasing age of women with higher and higher eta and beta values for older than the younger women. The model explained nearly 40 per cent of the total variation in the number of births which is slightly higher than that obtained for the Amhara women.

The Gurage ethnic group

The Gurage constituted a little over 18 per cent of the ever married women in the sample. Like the Oromo, most of the Gurage women in the sample were rural (80 per cent) and only 19 per cent were literate. More than three quarter of them were in a stable union and only 18 per cent approved of family planning. Unlike the Amhara and Oromo, most of the Gurage women in the sample were muslims (73 per cent). With respect to age at first marriage, 28 per cent married before they were 15, 52 per cent when they were between 15 and 17 and 20 per cent when they were 18 years or older (see Tables 6.1 and 6.2).

Mean number of children ever born by ever married Gurage woman aged between 15 years and 49 years is 4.42 which is slightly higher than that for the Amhara and Oromo but here again as Table 6.14 indicate, noticeable difference by background variables are present.

Table 6.14: Unadjusted and Adjusted Mean Number of Children Ever Born by Ever Married Gurage Women Aged 15-49.

Background variables	unadjusted means	Eta	Adjusted means	Beta
Residence				
rural	4.35		4.32	
urban	4.30	.06	4.82	.08
Literacy				
Literate	3.61		3.51	
Illiterate	4.61	.15	4.63	.17
Religion				
Christians	4.50		4.23	
Muslim	4.39	.02	4.49	.04
Age at marriage				
< 15	5.09		5.00	
15 -17	4.34		4.37	
18 or more	3.69	.19	3.74	.17
Marital stability				
Stable	4.28		4.41	
Not stable	4.03	.09	4.41	.01
Approval of Fp				
Yes	5.00		5.14	
No	4.30	.10	4.27	.13
Grand mean	4.42			
N	539			
R Squared				.17

Urban residence appears to have a slight negative effect on the number of births and the effect increases after adjusting for other variables in the model. The unadjusted means indicate that urban women had just over a third of a child fewer births than rural women but controlling for other predictors and age increased the difference to about half a child. The unadjusted means indicate that literate women had one child less than their illiterate counterparts and controlling for other variables increases the difference slightly. It may be observed that literacy and age at first marriage have similar effect on the number of birth. It may also be seen that these factors explain most of the variation in the number of births when the other variables are controlled.

Religion appears to be weakly related to the number of births. Although the unadjusted means for Christian women appears to be slightly higher than that for muslims, when age and the other predictors are adjusted, the excess for christians is removed and the average number of births become slightly lower. However, the difference in the mean number of births between christian and muslim Gurage women is negligible.

Women who married before their 15th birth day had on average three quarter of a birth higher than those who married between 15 and 17 and nearly one child more than those who married at age 18 or older. Differences are not reduced when age and other variables are controlled. From the gross difference, it appears that women in stable union had fewer births but when age and other variables were controlled, the difference disappeared and marriage disruption was no more an important predictor of the number of births. This may be due the much faster rate of remarriage after divorce or widowhood among Gurage women than Amhara or Oromo women. Approval of family planning affects the number of births positively just like it did in the other ethnic groups. Women who approved of family planning had larger number of births and the difference increases when the effect of age and all the other predictors are controlled.

Kambatana Hadiya Ethnic Groups

These are a group of people living in Kambatana Hadiya Awraja (District) of Shoa region. Like the Gurage, they also belong to the 'Enset Culture population'. They constitute about 12 per cent of the ever married women in the sample. Unlike women in the other ethnic groups, only 12 per cent of these women married before age 15. The proportion who married while between 15 and 17 and those who married at 18 years or older are respectively 56 and 34 per cent which indicates that age at first marriage is slightly higher than that for any other ethnic group considered here. Less than 20 per cent of them had experienced marriage dissolution and only 10 per cent approved of family planning. Although over 80 per cent of these women were christians, they did not belonge to the Ethiopian Orthodox Christianity but to the Protestant church which was introduced into the country recently (after World War II). Literacy was about 25 per cent and less than 10 per cent of the ever married women in the sample lived in urban areas.

They appear to have had the highest average number of children compared to any other ethnic group. Table 6.15 presents the gross and net means as well as the grand mean by background variables. Note that due to small number of Kambatana Hadiya women in Arsi, the variable region is excluded from the analysis.

Table 6.15 : Unadjusted and Adjusted Mean Number of Children Ever Born by Ever Married Kambatana Hadiya Women Aged 15-49 years.

background variables	unadjusted means	Eta	Adjusted Means	Beta
Residence				
Rural	4.56		4.58	
Urban	4.10	.04	3.95	.06
Literacy				
Literate	4.36		4.62	
Illiterate	4.57	.03	4.49	.02
Religion				
Christian	4.65		4.73	
Muslim	3.83	.10	3.49	.15
Age at marriage				
< 15	5.00		4.80	
15 - 17	4.45		4.60	
18 or more	4.47	.06	4.29	.06
Marital stability				
Stable	4.51		4.62	
Not Stable	4.59	.01	4.04	.07
Approval of Fp				
Yes	4.71		5.23	
No	4.5	.02	4.44	.08
Grand mean	4.52			
N	316			
R squared				.46

Residence appears to have a significant effect on the number of births as rural women had on average half a child higher births than urban women before and even after the effect of age and other factors were controlled. However, the urban sample is small and the estimates may be slightly biased and should be treated with care. Literate women appear to have slightly lower number of births when unadjusted means were considered but the adjusted means indicate that literate women have slightly higher births than the illiterate women.

Religion appears to be the most important predictor among the socio-economic variables included in the model. The gross difference in the number of children born is that christians had about a quarter of a child higher births than muslims and adjusting for age and other factors increases the difference to more than a child and a quarter. Unlike the other ethnic groups, among Kambatana Hadiya women, christians had substantially larger number of births compared to muslims. Similar findings are common in the literature. But further research is required to clarify the point that whether this is due to more pro-natalism among the christians than the muslims or due to any other cause. For the moment, it suffice to conclude that unlike other ethnic groups, muslims have a substantially lower fertility compared to the christians among Kambatana Hadiya women.

When differences in the number of births are considered by age at marriage, there is no difference in the gross means between women who married between 15 and 17 years of age and those at 18 or over but those who married while under 15 years of age had a little over half a child larger births than those who married at or after their 15th birth day. However, when the effect of age and the other explanatory variables are controlled, those who married between 15 and 17 years of age and those who married at 18 or older differed by nearly a third of a child while those who married before age 15 differed by about a fifth of a child. This shows that unlike women from other ethnic groups, for the Kambatana Hadiya women, there is not a significant difference in the mean number of births by age at marriage once the effects of other predictors are controlled.

The effect of marriage breakdown on the number of births also appears to be marginal. The gross mean is nearly the same for women with and without the experience of a marriage breakdown but controlling for age and other factors indicates that women in stable union had about half a birth more than those who had at least one marriage breakdown. Women who approved of family planning had slightly higher gross means than those who did not but when age and other variables are controlled, the net difference is that women who approved of family planning had over three quarter of a child higher than those who did not.

In general, the eta coefficients indicate that in gross terms, the number of children ever born is more affected by religion and age at first marriage than by the other factors in the model. The beta coefficient is highest for religion indicating that religion has the strongest effect on the number of children born when age and the other factors are controlled. Residence, age at marriage and marital disruption have nearly the same effect after the effect of age and the other variables are controlled.

6.6. Summary and Conclusion

The analyses presented in this chapter clearly demonstrate that there are differentials in fertility among the various population groups in Central Ethiopia.

Fertility is shown to be higher in Arsi than in Shoa. Mean number of births differ considerably between the two regions even after controlling the effects of age and other predictors in the various models suggesting that the regional fertility differentials are caused to a large extent by factors such as infant and child mortality than by those included in the models.

Although urban fertility generally appeared to be slightly lower than rural fertility, age group wise analyses of births indicate that gross means are slightly higher for young and middle aged urban women while older urban women had considerably lower gross means. When adjusted for age and other factors, however, urban women had lower means in all age, and ethnic groups.

Literate ever married women aged 15-49 are shown to have lower gross and net means in all the analyses. However, the analyses by age group depicts that literate ever married women in the young and middle ages of reproduction in the urban areas had higher gross and net means than their illiterate counterparts while those nearing the end of their reproductive period had lower means in all cases. This may imply that literate women have developed smaller family norms and like to achieve desired family size while still young by closely spacing their births and want to prevent later births by using birth control. This appears to be a plausible explanation as most literate women are aware of some method of birth control.

Unlike literacy, religious differentials are found to be significant in all cases although the muslim - christian fertility differential is smaller for younger women. Christian women had lower gross and net means than muslims within urban and rural areas as well as within ethnic groups except for the Kambatana Hadiya ethnic groups. This appears to be in agreement with the 'characteristics' (or 'assimilationist') hypothesis which states that the religious differentials in fertility are essentially the results of differences in the demographic, social and economic attributes of the members of the religious groups (Chamie, 1981). Fertility is lower for christian women because they are more literate, more urbanized, less in stable union and have lower infant/child mortality than muslim women. The higher christian than muslim fertility among the Kambatana Hadiya is perhaps due to the fact that most women in this ethnic group were recent converts to the Protestant Christianity from a traditional faith which favoured high fertility.

The investigation of ethnic fertility differential shows that in gross terms, number of births to Amhara ever married women is slightly smaller than for other ethnic groups among those aged 15-49. But when the effects of age and other factors are controlled, the number of births for the Amhara and Oromo ethnic groups were nearly identical and smaller than that of the Gurage and Kambatana Hadiya women. The analysis for age groups indicated that pronounced ethnic fertility differentials are not present among young women and that net means differed very little between Amhara and Oromo and between Gurage and Kambatana Hadiya ethnic groups in the middle and latter years of reproduction.

Age at marriage and marital disruption are shown to be the only most important determinants of fertility. Most of the socio-economic differentials appear to be due to differences in these variables. Differences in both gross and net means are considerable between women in stable union and those with one or more marriage disruptions. Also, gross as well as net means differ to a large extent by age at marriage especially between those who married before age 15 and those who married at age 18 or over. In all the analyses, women who approved of family planning were shown to have substantially higher number of births even when age and other variables were controlled.

In general, differences are present but in most cases they are weak perhaps due to the little difference in the socio-economic as well as demographic variables in the model. Most of the differentials in fertility may be attributed to differentials in infant/child mortality. The lack of difference or the diminishing differential in fertility among the younger women observed in the age stratified analyses may indicate the beginning of a fertility transition in the population.

A final important point worth noting is that the fertility predictors included in the analysis explained less than half of the variation in the number of children ever born and that socio-economic differences remained even after the effects of age at marriage and marital disruption have been controlled. This is a point found in a number of other studies (see Rindfuss, et al., 1989). This may be due to problems of specification, i.e., the omission of important explanatory variables from the model or the use of wrong models. We have pointed out earlier that due to lack of information, a number of socio-economic and demographic determinants were not included in our analysis and this may partly explain this anomaly.

Figure 6.1: Distribution of Currently Divorced or Widowed Women by Residence.

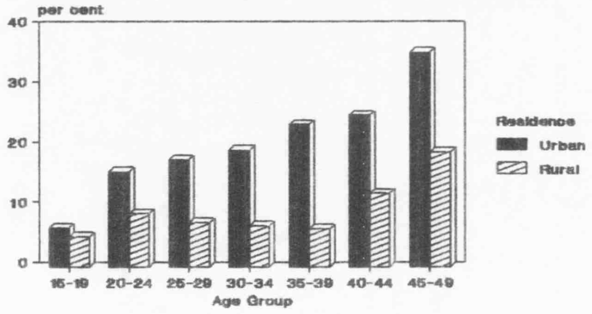


Figure 6.2: Distribution of Currently Divorced or Widowed Women by Literacy.

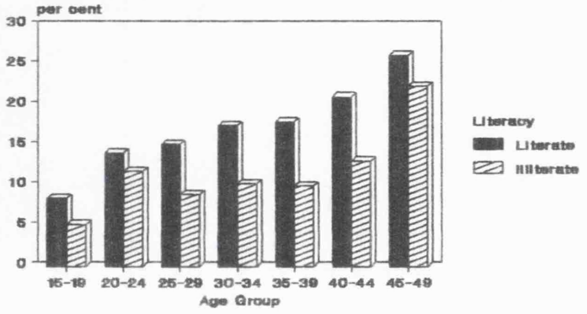


Figure 6.3: Distribution of Currently Divorced or Widowed Women by Religion.

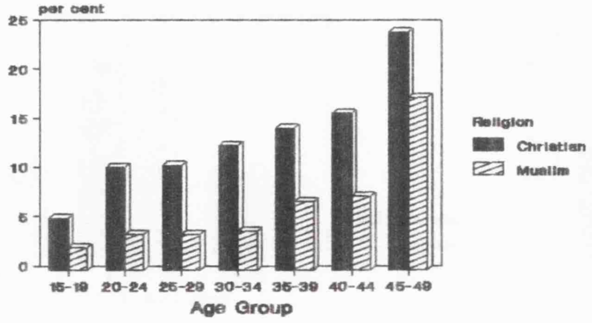


Figure 6.4: Distribution of Currently Divorced or Widowed Women by Region.

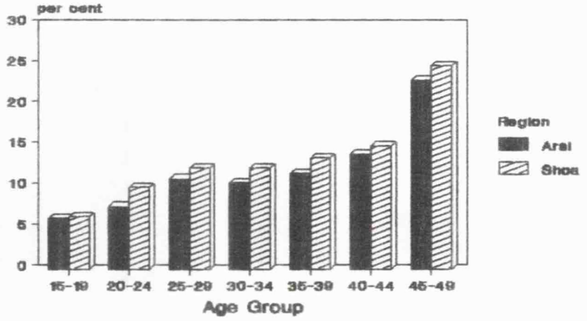


Figure 6.5: Distribution of Currently Divorced or Widowed Women by Ethnicity.

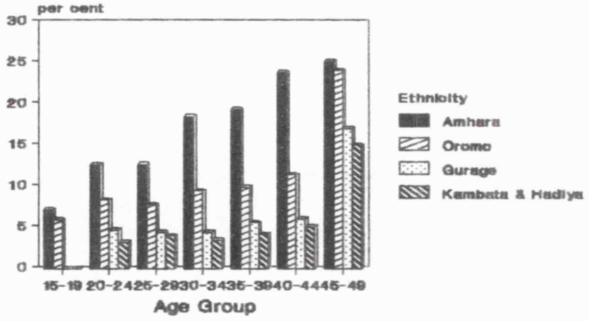


Figure 6.6: Distribution of Women by age at first Marriage and Residence.

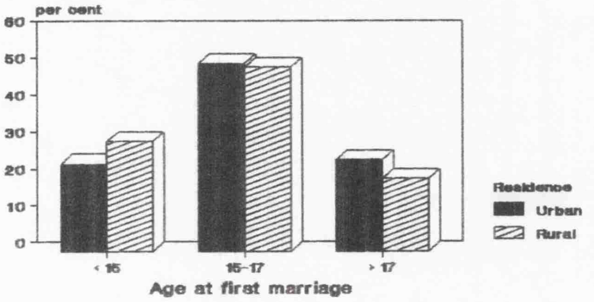


Figure 6.7: Distribution of Women by Age at First Marriage and Literacy.

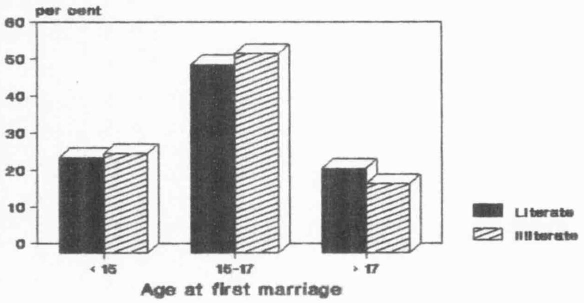


Figure 6.8: Distribution of Women By age at First Marriage and Religion.

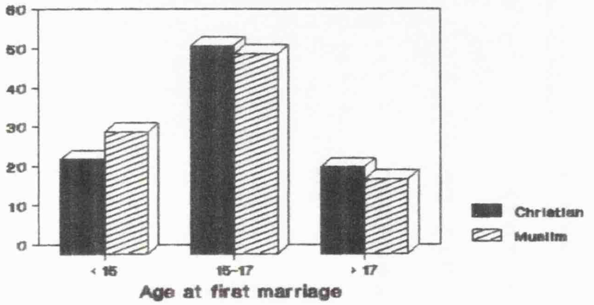


Figure 6.9: Distribution of Women by Age at First Marriage and Region.

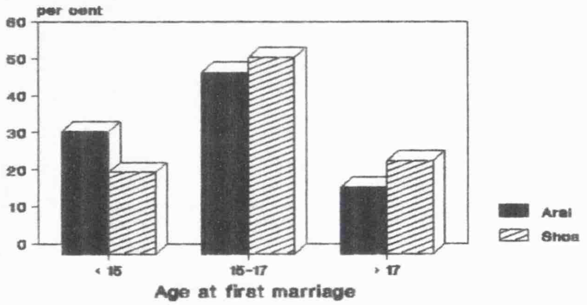
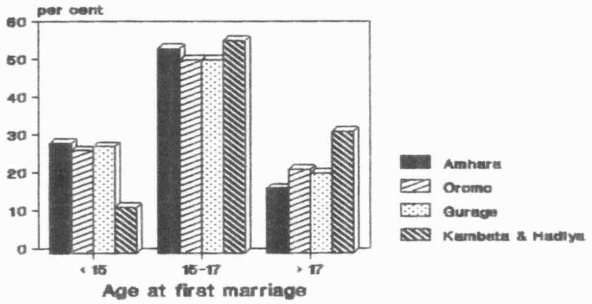


Figure 6.10: Distribution of Women by Age at First Marriage and Ethnicity.



CHAPTER VII

SUMMARY AND CONCLUSIONS

Available fertility studies in Ethiopia (Mengistu, 1989; Ketema, 1985; Berhanu, 1985a; Sileshi, 1986; C.S.O., 1984a) fail to describe the reproductive behaviour of Ethiopian women mainly due to absence of adequate demographic data. Most of these studies (Mengistu, 1989; Berhanu, 1985a; C.S.O. 1984a) are simplistic in that they only provide estimates of levels and do not attempt to investigate socio-economic differentials. Moreover, they do not explain the determinants of the prevailing level of fertility. Although some studies (Ketema, 1985; Sileshi,1985) have made some effort to investigate and explain the causes of differential fertility in the population, their results were inconclusive because of the exclusion of appropriate demographic variables in their models.

By utilizing data mainly from the Ministry of Health birth history survey, this thesis has examined in detail the levels, trends and differentials of fertility in central Ethiopia. Although the main initial objective of the thesis was to investigate fertility trends and their socio-economic correlates in the population, it was found necessary to devote a substantial portion of the thesis to the evaluation of the quality of the data on which it is based and the imputation of missing, incomplete or inconsistent dates of events in the birth history. This was done mainly because the usefulness of any study depends on the quality of the data used. Moreover, the detection and identification of the types and sources of error and their magnitude and the effect of correction procedures on the results obtained may be useful in the design, execution and analysis of future surveys.

The evaluation of the quality of the data in Chapter Three revealed the existence of various types of error. The age data were affected by considerable heaping on digits ending in multiples of 5 and to a lesser extent on 8. It was shown that ages ending in 1,3 and 9 were substantially avoided. Meyers' indices computed for the male population were 25.5 and 17.5 respectively in the rural and urban areas while the corresponding values for the female population were 24.1 and 16.2 respectively for rural and urban areas. These values indicate that heaping is substantially lower in the urban areas compared to the rural areas. Relative improvement in the quality of female age data was notable when compared to the 1981 C.S.O survey data perhaps due to the collection of both date of birth and age at interview in the M.O.H. survey. However, examination of the lower and upper eligible age ranges indicated that a substantial number of potentially eligible females were excluded from the interview at these ages. The exclusion of eligible women from the lower end may be due to age shifting while that at the upper end was probably deliberately made by the enumerators in order to reduce the work load by eliminating older women who had large number of live births. Distortions arising from factors other than age reporting have also been observed in the data. The sex distribution showed extremely low values in the five 5-

year age groups between 15 and 40 years. The 1977/78 Ethiopian-Somalia war, the 1984/85 resettlement programme which resettled about 1.2 per cent of the entire population of Shoa in Northwestern, Western and Southwestern regions of the country and the ongoing civil war in the Northern regions of the country had all affected the age and sex distribution of the population.

The nuptiality data indicated a sizeable amount of missing or partially reported dates of marriage for ever married women. There were also substantial numbers of women who reported the date of betrothal instead of the date of cohabitation and this resulted in unusually long first birth intervals - sometimes exceeding 10 years, but part of this may be due to the fact that the early years of marriage are barren because of adolescent subfecundity. Omission of first marriages appeared to be negligible in the population.

In the birth histories, dates of birth were missing, incomplete or inconsistent for about 13 per cent of the births. Consequently, the birth intervals were undefined, negative or smaller than the biologically accepted minimum for these births. Moreover, the birth intervals showed marked heaping on multiples of 12 months arising probably from reporting the ages of children in rounded years instead of reporting date of birth in year and month or the number of years and months since the birth of the child. The sex ratio of children ever born and those dead indicated that omission of children ever born was minor. There were also some displacement of dates of birth from the remote past closer to the survey date. When children ever born were compared with those obtained from the C.S.O. 1981 survey, the reporting of live births was much better in the M.O.H. survey and this may be due to the collection of information on the total number of children ever born by a woman and also on each of her births in chronological order.

Chapter four discussed the problems of incomplete data, methods of handling such data, imputation of missing, incomplete or inconsistent dates of events in the M.O.H. survey using DEIR and the nature of the imputed data. The results of imputing missing, incomplete or inconsistent dates of events showed that the effect of imputation was marginal on estimates of fertility up to 10-14 years before the survey. The cumulated period fertility for the period 0-4 years before the survey increased by less than 3 per cent and that for the 5-9 year period increased by 3.8 per cent while for the 10-14 years, it increased by 4.2 per cent on the average. Similarly, cumulated cohort rates increased by about 5 per cent for the recent 5 year period, by 8 per cent for the 5-9 years period and by 11 per cent for the 10-14 years period before the survey after imputation. For the remote past however, average increases in both period and cohort cumulated fertility were substantial indicating that reporting of dates worsened as one got further and further from the survey date.

Changes in the estimated average ages of the respondent and age at first marriage were also shown to be negligible as the mean, median and various percentile values obtained from the original and imputed files indicated. However, little difference in the mean and median birth intervals were obtained after imputation. Also unacceptable birth intervals were adjusted and heaping on multiples of 12 months was reduced.

Although the change in the measures of central tendency (mean, mode, median, etc.) of the date related derived variables was negligible after imputation, the gain in the number of cases was substantial. After imputation, it was possible to analyse the entire sample of 3,431 women whereas before imputation, it was possible to analyse only 2,361 women. Moreover, some changes in the coefficients of a multiple regression line fitted to the number of births during the most recent five year period were also observed after missing, incomplete or inconsistent dates were imputed. Although the proportion of total variation in the dependent variable explained by the independent variables as measured by the coefficient of multiple determination (R^2), did not show much increase, partial correlations and inter-correlations between explanatory variables have changed to some extent. Coefficients of the regression equation (Bs) and their standard errors have also changed to some extent as a result of imputation. Increases of 10 per cent or more in the absolute magnitude of the coefficients was obtained after imputation.

In general, the chapter showed that due to imputation of missing, incomplete or inconsistent dates of events, some degree of consistency has been achieved and that it has enabled the analysis of the entire data file using standard complete-data methods of analysis. However, the cost of achieving this consistency appears to be far greater than the gain in data improvement. Moreover, there is no guarantee that the imputed data are the true representations of the actual values. The deployment of well trained interviewers in the collection of the data and care taken during field and office editing are believed to be critically important for obtaining good quality data than imputation and it may be suggested that more time and money be spent to improve the actual data collected rather than on imputation of incomplete data.

In chapter five, fertility levels and patterns have been analysed by using various techniques. It was shown that fertility has been high and that recently marked rises have taken place. Estimated total fertility of 7.12 children per woman for the most recent five year period before the survey corresponds with a net reproduction rate of about 2.6. This is more than two and half times the value required for replacement fertility at the prevailing level of mortality.

The high level of fertility observed in the population is interpreted in terms of social and cultural factors favouring high fertility. Marriage being the norm, women marry early. Early and universal marriage is a major determinant of high fertility in traditional populations experiencing natural fertility. Early marrying women are exposed to the risk of childbearing for longer durations than those who marry late and this eventually leads to high level of fertility. In addition, the high value placed on having many children in order to ensure support for the family and security in old age in conditions of high infant and child mortality, the importance of motherhood and the stigma attached to infertility are also considered responsible for the high levels of fertility in the population.

The analysis of fertility trends revealed that total fertility per women was constant around 6.0 children in 1970. It then increased to about 7.5 children per woman between 1972 and 1976, reached about 8.0 children between 1977 and 1981. This shows that period fertility increased by about 33 per cent between 1970 and 1981. Estimates of TFR obtained from independent sources (1970 and 1981 C.S.O. surveys) also showed increases of similar magnitude. Although data quality has substantially improved over the years because of the use of better trained field and office staff and also because of improved literacy of the population, the increase in fertility was much more than what can be attributed to improvements in data quality alone. Between 1982 and the survey date however, TFR declined to a little over 7.0 children per woman. This recent sudden drop in TFR may not be realistic in a society where no dramatic change regarding reproductive norms and behaviours have occurred. As pointed out earlier in the thesis, this is attributed to the socio-economic problems in the country rather than due to problems in the data.

It was also shown that while fertility increased in rural areas, it declined moderately in the urban areas during the last fifteen years. It was suggested that the prevailing acute shortage of housing which resulted in many doubled up households in the urban areas must have limited privacy and reduced coital frequency. In addition, commercially available contraceptives in pharmacies and drug stores which can be bought without any prescription might also have contributed to the moderate decline in urban fertility during the period.

Decomposition of the TFR into its various components indicated that a substantial amount of the increase in fertility was due to changes in marital fertility. Although noticeable changes in the pattern of marriage were also observed during the period 1970 to 1986, its effect was shown to contribute substantially less than the change in the fertility of married women to the change in TFR. It was suggested that decline in the duration and intensity of breastfeeding that was not compensated by contraceptive use, the reduction in spousal separation due to reduced temporary migration, and the reduction in widowhood resulting from the relative decline in mortality were responsible for the changes in marital fertility.

By utilizing additive models that employ regression techniques in order to determine the net effect of socio-economic and demographic variables, chapter six provides some useful information regarding the socio-economic and demographic correlates of fertility in the population.

Children ever born was used as a dependent variable in our model. Region, residence, literacy, religion, ethnicity, age at first marriage, marital disruption and approval of family planning were used as explanatory variables to examine overall fertility differentials in the population. Then separate analysis was carried out for ever married urban, rural and ever married women in each of the four ethnic groups, Amhara, Oromo, Gurage and Kambatana Hadiya. In each case, ever married women aged 15-49 were analysed and then those in each of the three broad age groups 15-24, 25-34 and 35-49 (except for Gurage and Kambatana Hadiya women because of small samples). The purpose of this stratified analysis was to control for certain un observable cultural and environmental effects as well as in order to observe cohort effects.

The results of the analyses show that fertility differed by region, residence, literacy, religion and ethnicity. Ever married women in Arsi region were identified as having higher average births compared to those in Shoa. Both urban and rural ever married women as well as women in each ethnic group (Amhara, Oromo and Gurage) had higher averages in Arsi. Findings were consistent for women in each of the three age groups (15-24, 25-34 and 35-49) though regional differences were marginal for women in the young and middle years of reproduction. The relatively higher infant/child mortality and the resulting shorter duration of post-partum amenorrhoea in Arsi than in Shoa were suggested as factors that partly explain the higher fertility in Arsi.

Urban fertility was shown to be lower than rural fertility. Number of births per woman was higher in rural areas in general but differences were more pronounced for women approaching the end of their reproductive years. Literacy had a negative but weak effect on number of births for all ever married women aged 15-49. Average births were the same for literate and illiterate women in the young and middle reproductive years but older literate women had about 11 per cent lower average births compared to illiterates. There was no significant difference in average births by literacy status among urban women aged 15-49 and for those in the young and middle years of reproduction, literate ones had slightly higher average births than the illiterate ones while literate women nearing the end of their reproductive years had lower average births. In rural areas however, literate women were shown to have lower average births in all the analyses. This is perhaps because they experienced lower infant/child mortality and consequently longer duration of breastfeeding compared to their illiterate counterparts. Young and middle aged urban literate women on the other hand, were probably closely spacing their births so as to achieve desired family sizes at younger ages and wanted to prevent childbearing in later years of reproduction.

Muslim fertility appears to be higher than christian fertility in general. Average births were shown to be higher among ever married muslim women in rural areas as well as in urban areas and for each age group. Also muslim Oromo women had higher average births than christian Oromo women. However, among the Kambatana Hadiya, average births were lower for muslim women than for christians. The reason probably is that unlike women in other ethnic groups, these women were recent converts to protestant christianity from a traditional belief. The higher muslim than christian fertility is associated with the lower status of muslim women and also to the higher infant/child mortality among muslims than christians.

It was also shown that in spite of their less stable marriage, higher literacy and higher proportion urban, than the other ethnic groups, the Amhara do not significantly differ in their fertility from the Oromo. There was also no significant difference in the fertility of the Gurage and the Kambatana Hadiya ethnic groups. However, there appears to be a significant difference between the Amhara/Oromo on one hand and the Gurage/Kambatana Hadiya on the other with the Amhara/Oromo identified as having lower fertility and the Gurage/Kambatana Hadiya as having higher fertility in Central Ethiopia. Separate analyses by age group did not show significant ethnic differential at young and middle years of reproduction while those in later years did differ substantially between Amhara/Oromo and Gurage/Kambatana Hadiya ethnic groups with Amhara/Oromo having lower fertility. The higher Gurage/Kambatana Hadiya fertility may be due to their relatively higher infant/child mortality compared to the Amhara/Oromo. When these ethnic groups were separately analysed, it was shown that there was no noticeable difference in fertility between urban and rural or literate and illiterate Amhara women. There was no significant fertility differential by residence for Oromo women also but there was a substantial difference by literacy with literate Oromo women having lower average births than the illiterate ones.

Age at marriage and marital disruption were identified as the most important determinants of fertility in Central Ethiopia. Average births were shown to be substantially lower for women who married at age 18 or later than those who married younger than this age. Also average births were lower for women with one or more marital breakdowns than those in stable union. This is true for urban as well as rural women though the effect of marital breakdown is weaker for rural women than for urban women probably because of faster remarriages of divorced or widowed women in rural areas than in urban areas where most of the widowed or divorced women prefer to stay unmarried. It was also shown that the effect of age at marriage was slight at older ages and that of marital breakdown at younger ages. From the values of the coefficients of the regression models (eta and beta), it appears that these two variables explain most of the variations in fertility in the population.

Although approval of family planning had high eta and beta values, it appears to affect fertility positively. Women who approved of family planning were identified as having substantially larger average numbers of births than those who did not. This may indicate that women who approved of family planning were those with higher fecundity.

The chapter has shown that there is some degree of socioeconomic differentiation in fertility in the population and that these differences were not removed even when the effects of age at marriage and marital disruption (which are among the most important determinants of fertility in a natural fertility population) were controlled. This may suggest that there are errors of specification in the model. Important variables might have been omitted from the model or the use of additive models may be inappropriate in this case.

In general, the thesis has shown that fertility is high in Central Ethiopia and that recently, it has been rising. The thesis has also shown that even with such high level of fertility, differences exist between population subgroups.

Whether a substantial fertility decline can occur in these regions or for that matter in the whole country in the near future is questionable. The ongoing civil wars and the recurrent drought with its associated famines may lead to a relative decline in fertility in the short run because of postponement of some marriages and temporary separation of spouse, among others. However, fertility may ascend once again as some or all of these problems are mitigated unless some change in the factors that enhance high fertility, such as the value of children and high levels of infant and child mortality occur. Even if changes occur in some or all of these factors, it may take some time before an accelerated decline in fertility occurs as there is no effective family planning programme in the country. In short, a complete fertility transition seems unlikely to materialize until the cultural specification of adult status and prestige dissociates from family size, parents are convinced that infant and child mortality have fallen to a level that assures them that a desired number of children can survive to adult age, social security becomes available to both men and women at old age or at times of need, and also the decline in breastfeeding intensity and duration is fully compensated by contraceptive use. Moreover, as significant differences in the level of fertility prevail in the population and as these differences are due to differences in socio-economic variables, fertility decline may not occur in all subgroups of the population simultaneously until the process of development that affect fertility (such as health services and education) are equally distributed among the population groups. As these groups of the population remain deprived of access to factors that affect fertility, social and economic inequality may be exacerbated by increases in absolute population numbers due to high fertility. In low income countries like Ethiopia, apart from resulting in rapid population growth, high fertility may also affect the health and general wellbeing of the population. In such countries, with poor sanitation and anti-natal care, and low level of nutrition, high fertility often leads to high maternal and child death rates. Frequent pregnancies and child birth debilitate the mother's health and increase her chance of death. Short birth intervals also reduce the survival chance of children (Ascadi and Ascadi, 1986). Therefore, in order to reduce fertility from its current level and achieve a lower level, some policy oriented measures must be taken.

First, the very high level of infant and child mortality must be reduced in order to assure parents that a given number of their offspring can survive to adult age. Once parents become aware that health conditions do not necessitate hoarding children against future losses, their family size desires are likely to change. Higher infant/child survival probabilities also affect fertility by suppressing ovulation through longer duration of lactational amenorrhoea.

Second, as the traditional practice of birth spacing through prolonged breastfeeding is gradually fading away, modern contraception might therefore be most effectively promoted as a possible alternative. Although historical analysis suggests that fertility can be reduced without access to modern contraception, availability of modern family planning methods may accelerate the decline in fertility. We have shown that knowledge as well as practice of fertility control mechanisms are not widespread in the population. The promotion and support of coordinated population information and education focusing on the consequences of high fertility on maternal and child health, the role of breastfeeding on infant/child health and on child spacing, and the availability of modern family planning methods, among other things may be useful in increasing the awareness of the general public on population issues and may bring a sustained decline in fertility.

Third, the legal age at first marriage should be increased to at least 18 years. In populations where effective family planning is absent, the timing of first marriage bears directly upon fertility patterns including the age at which the woman gives birth to her first child, the nature and pattern of her subsequent reproductive events as well as her complete family size (Ascadi and Ascadi, 1986).

It was shown that over 78 per cent of the ever married women in Central Ethiopia were married before they were 18 years old and that the median age at first marriage was about 16 years - lower than the value for most of Sub-Saharan

African countries. It was also shown that women who married while under 15 years of age had about 0.80 children more than those who married at 18 years of age or older when the effects of age and other predictors are controlled (Table 6.3) and that nearly three quarter of the ever married women with at least one live birth had their first birth before they were 20 years old. As the social status of a women is measured by motherhood, women who marry early, start childbearing early and aggregate fertility tends to be high. Moreover, an early start of childbearing may lead to achievement of desired family size at younger ages and consequently to a longer period of exposure of unwanted births. Hence it may be recommended that an increase of the legal age at first marriage up to at least 18 years may have a substantial effect in reducing fertility. However, it is important to emphasize that the increase in the legal age at first marriage may precipitate increased premarital sexual activity and undesired illegitimate births, but this can be avoided by making available effective methods of birth control. Increased opportunity for female education and employment can be a useful instrument in implementing the policy. Increased educational opportunity may also lead to a decline in fertility in the long run by affecting traditional beliefs and attitudes towards large family, increasing the cost of rearing children, and reducing their contribution as source of household labour.

Finally, it may be pointed out that since this study is based on the population of Arsi and Shoa only, it may not reveal the fertility situation in the country or in other regions. In order to have a broader picture of the fertility situation in the country, it is useful to carry out similar studies in other regions as well. Moreover, this study was basically on the quantum of fertility and not on the tempo. Although quantum and tempo are not independent, measuring the change in the pace of childbearing and its determinants provides useful information for policy issues. Hence more elaborate research may be needed in this area.

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AWRAJA

WOREDA

KEBELE

HOUSEHOLD NAME

POPULATION, HEALTH & NUTRITION PROJECT
BASELINE SURVEY
HOUSEHOLD SCHEDULE

	NAME LIST THE NAMES OF ALL PERSONS WHO USUALLY LIVE HERE AND OF ALL VISITORS WHO SLEPT HERE LAST NIGHT	**RELATIONSHIP** STATE RELATIONSHIP TO HOUSEHOLD HEAD AND OTHER MEMBERS SPECIFYING LINE NUMBERS - E.G. "SON OF 1&2"	**RESIDENCE**		**SEX** M OR F	**AGE** IN COMPLETED YEARS	**TRIBE OR NATIONALITY** FOR ETHIOPIANS, STATE TRIBE FOR FOREIGNERS, STATE NATIONALITY	**RELIGION** STATE WHETHER CHRISTIAN, MUSLIM, OTHER OR NONE	IS FATHER ALIVE ? YES/NO	IS MOTHER ALIVE ? YES/NO	TICK IF ELIGIBLE FOR INDIVIDUAL INTERVIEW
			DOES HE/SHE USUALLY LIVE HERE?	DID HE/SHE SLEEP HERE LAST NIGHT?							
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											

PRINCIPAL WATER SOURCE	DRY SEASON	WET SEASON
PRIVATE TAP	1	1
PUBLIC TAP	2	2
WELL	3	3
POND OR LAKE	4	4
STREAM OR RIVER	5	5
SPRING	6	6

TYPE OF LATRINE

FLUSH WC 1

BUCKET 2

PIT 3

NONE 4

TYPE OF ROOF

THATCH 1

CORRUGATED IRON 2

TILES 3

OTHER 4

TYPE OF FLOOR

EARTH 1

CEMENT 2

WOOD 3

OTHER 4

HOUSEHOLD GOODS	Yes	No
PACK ANIMALS	1	2
LIVESTOCK....	1	2
ELECTRICITY.. (URBAN AREAS ONLY)	1	2
RADIO.....	1	2

ENUMERATOR'S SIGNAT ____________

DATE ____________

CLUSTER NO ☐☐

GOVERNMENT OF SOCIALIST ETHIOPIA

POPULATION, HEALTH AND NUTRITION PROJECT

BASELINE SURVEY

INDIVIDUAL QUESTIONNAIRE FOR FEMALES AGED 15-50 YEARS

HOUSEHOLD NUMBER .... ☐☐

AWRAJA ....

WOREDA ....

KEBELE ....

NAME OF HEAD OF HOUSEHOLD ....

WOMAN'S NAME ....

LINE NUMBER FROM HOUSEHOLD SCHEDULE .... ☐☐

DATE OF INTERVIEW (DAY, MONTH) .... ☐☐ ☐☐

NAME OF INTERVIEWER ....

SECTION 1 WOMAN'S BACKGROUND

101 Do you live in this house?

YES 1 NO 2

102 Do you live in this Kebele?

YES 1 NO 2

103 Do you live in this Woreda?

Yes, lives in this Woreda - rural 1
urban 2
No, lives outside this Woreda - rural 3
- urban 4

104 Have you always lived in this Kebele/there?

YES 1 NO 2

105 For most of the time until you were 12 years old, did you live in the country or in an urban area?

Country	Urban area
1	2

106 How old are you?

________ YEARS

(Record the best estimate)

107 Can you tell me the date of your birth?

DAY or SAINT'S DAY ______________

MONTH ______________

YEAR ______________

DON'T KNOW ______________

Interviewer: compare the answers to 106 and 107 and check that they are compatible. If not, probe and correct.

108 Have you ever been married?

YES	NO
1	2
	SKIP T

109 Are you married, widowed, divorced or separated?

MARRIED	WIDOWED	DIVORCED	SEPARATED
1	2	3	4

110 Does your husband usually live with you or is he now staying elsewhere?

LIVING WITH HER	STAYING ELSEWHERE
1	2

111 How many times have you been married?

ONCE ONLY	MORE THAN ONCE
1	2

112 Can you tell me the date when you were (first) married and started living with your (first) husband or his family?

DAY or SAINT'S DAY ____________ DON'T KNOW

MONTH ____________

YEAR ____________

113 How old were you when you were (first) married?

__________ YEARS

114 Have you ever been to school?

YES 1 NO 2

115 What was the highest level or grade you attended?

	Grades
1 PRIMARY	1-6
2 SECONDARY	7-8
	SKIP TO 117
3 HIGHER	9-12 and other higher education

116 Can you read this piece of text to me?

(Present respondent with test text)

READS	EASILY	1
	WITH DIFFICULTY	2
	NOT AT ALL	3

117 Do you listen to the radio at least once a week?

YES 1 NO 2

SECTION 2 MATERNITY HISTORY

We need to get a complete record of all the babies each woman has actually given birth to up till now.

201. Have you any children who are now living with you?

Yes No: write 0

↓ ↓

How many?________ of these, how many are boys? __________

how many are girls? _________

202. Have you any children who are living elsewhere (including any who are now grown up and married?)

Yes No: write 0

↓ ↓

How many? _______ of these, how many are boys? _________

how many are girls? ________

203. Have you ever given birth to any children who later died (even if they lived for only a short time)?

Yes No: write 0

↓ ↓

How many?_________ of these, how many were boys?_________

how many were girls?________

204. INTERVIEWER: SUM ANSWERS TO 201, 202 AND 203

TOTAL ___________ NOW ASK: Just to make sure I have this right, you have had ... births. Is that correct?

IF NO, PROBE AND CORRECT AS NECESSARY.

IF ZERO BIRTHS, GO TO 501

IF AT LEAST 1 BIRTH, CONTINUE WITH 205.

Now I want to ask some questions about each of your births, starting with the first birth you had.

ASK 206-209 FOR EACH BIRTH, STARTING WITH THE FIRST.

IF TWINS, USE ONE LINE FOR EACH AND CONNECT WITH A BRACKET AT THE LEFT.

BIRTH ORDER	205 NAME OF CHILD	206 DATE OF BIRTH			207 SEX BOY 1 GIRL 2	208 NOW ALIVE OR DEAD? ALIVE 1 DEAD 2	209 IF DEAD AGE AT DEATH	
		DAY OR SAINT'S DAY	MONTH	YEAR			YEARS	MONTHS
01								
02								
03								
04								
05								
06								
07								
08								
09								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

SECTION 3 HEALTH

CHECK 206. ONE OR MORE LIVE BIRTHS BORN SINCE JAN. 1981 YES 1 ↓ NO 2 ↓ SKIP TO 501

ENTER THE NAMES OF THESE CHILDREN, STARTING WITH THE MOST RECENT, AND TICK WHETHER ALIVE OR DEAD.

"Now I would like to ask you some questions about the health of your children who are under 5 years of age."

. "Have you ever heard of vaccinations to prevent childhood diseases?"

Yes 1 ↓ No 2 ↓ SKIP TO 304

	LAST BIRTH NAME: ALIVE[ ]DEAD[ ] ↓ ↓	NEXT TO LAST NAME: ALIVE[ ]DEAD[ ] ↓ ↓	SECOND FROM LAST NAME: ALIVE[ ]DEAD[ ] ↓ ↓	THIRD FROM I NAME: ALIVE[ ]DEAI ↓
."Do you have a vaccina- n card for (NAME)"? YES, SEEN ......1 ES, NOT SEEN ..2→ SKIP TO 304 NO CARD EVER ...3→ GO TO 303 ES, "May I see it, please?" CORD IMMUNIZATIONS EIVED YES NO				
BCG 1 2				
DPT 1 1 2				
DPT 2 1 2				
DPT 3 1 2				
POLIO 1 1 2				
POLIO 2 1 2				
POLIO 3 1 2				
MEASLES 1 2				
ES TO ANY IMMUNIZATION, IP TO 304				
3. "Has(NAME) ever had a ination to prevent him/ from getting diseases?" YES .....1 NO ......2 D.K......3				
	IF CHILD DEAD, SKIP TO 401	IF CHILD DEAD, SKIP TO 401	IF CHILD DEAD, SKIP TO 401	IF CHILD DEAD SKIP TO 401
. "Has(NAME) had rrhoea at anytime during ast 2 weeks?" YES .....1 NO ......2 } SKIP D.K......3 } TO 308				
. "Did you or anybody do something to treat iarrhoea? YES .....1 NO ......2 } SKIP D.K......3 } TO 307				

	LAST BIRTH NAME: ALIVE[ ]DEAD[ ] SKIP TO 401	NEXT TO LAST NAME: ALIVE[ ]DEAD[ ] SKIP TO 401	SECOND TO LAST NAME: ALIVE[ ]DEAD[ ] SKIP TO 401	THIRD TO L NAME: ALIVE[ ]DE SKI
306. "What was done?" YES NO				
RAL REHYDRATION PACKET 1 2				
ME SOLUTION OF SUGAR, SALT AND WATER 1 2				
HER HOME SOLUTION 1 2				
TABLETS, JECTIONS OR YRUP 1 2				
307. "Were all fluids thdrawn?" YES 1 NO 2				
8. "Has(NAME) had fever malaria at anytime during the last 2 weeks?" FEVER 1 MALARIA 2 NO 3 SKIP D.K . 4 TO 311				
9. "Did you or anybody else do something to treat e fever or malaria?" YES 1 NO 2 SKIP D.K. 3 TO 311				
310. "What was done?" YES NO				
CHLOROQUINE 1 2				
ASPIRIN 1 2				
INJECTION 1 2				
ORAL REHYDRATION 1 2				
TRADITIONAL MEDICINE 1 2				
OTHER 1 2				
311. "Has(NAME) had a rsistent cough at anytime ing the last 2 weeks?" YES ......1 NO ....2 SKIP D.K.......3 TO 401				

	LAST BIRTH NAME: ALIVE[ ]DEAD[ ] ↓ SKIP TO 401	NEXT TO LAST NAME: ALIVE[ ]DEAD[ ] ↓ SKIP TO 401	SECOND TO LAST NAME: ALIVE[ ]DEAD[ ] ↓ SKIP TO 401	THIRD TO LAS NAME: ALIVE[ ]DEAD ↓ SKIP 40
12. "Did you or anybody else do some thing to reat the cough?" YES 1 NO 2 } SKIP TO D.K. 3 } 401 13. "What was done?" YES NO TABLETS, SYRUP, or INJECTION 1 2				
ORAL REHYDRATION 1 2				
TRADITIONAL MEDICINE 1 2				
OTHER 1 2				

SECTION 4 BREASTFEEDING

"Now I would like to ask you some questions about the birth of your children who are nder 5 years of age."

ASK THE QUESTIONS FOR ALL CHILDREN - ALIVE OR DEAD - BORN SINCE JAN. 198

	LAST BIRTH NAME: ALIVE[ ]DEAD[ ] ↓ ↓	NEXT TO LAST NAME: ALIVE[ ]DEAD[ ] ↓ ↓	SECOND FROM LAST NAME: ALIVE[ ]DEAD[ ] ↓ ↓	THIRD FR NAME: ALIVE[ ] ↓
01. "When you were pregnant ith(NAME), were you given injection to stop him/ r from getting tetanus onvulsions)?" YES 1 NO 2 D.K. 3				
. "Where did the birth f (NAME) take place?" HOSPITAL OR HEALTH CENTER.......1 AT HOME .....2 AT MOTHER'S HOME ....3 OTHER 4				
. "Who assisted with e birth of(NAME)?" OCTOR ....1 URSE OR MIDWIFE ....2 TRADITIONAL BIRTH TTENDANT-TRAINED ...3 RADITIONAL BIRTH ATTENDANT-UNTRAINED .4 ELATIVE ....5 THER ....6 NO ONE...............7				
LAST AND NEXT-TO-LAST RTHS ONLY				
. "Did you ever breast-ed(NAME)?" YES 1 NO 2 ->SKIP TO 406				
5. "For how many months you breastfeed(NAME)?" NUMBER OF MONTHS ______ TILL BREASTFEEDING .....97 BREASTFED. TILL EATH ....98 ON'T REMEMBER 99				

	LAST BIRTH NAME: ALIVE[ ] DEAD[ ]	NEXT TO LAST NAME: ALIVE[ ] DEAD[ ]
406. "How many months after the birth of (NAME) did your normal periods return?" NUMBER OF MONTHS ______ NOT RETURNED .... 98 DON'T REMEMBER 99		
407. "How many days after the birth of (NAME) did you resume sexual relations with your husband?" NUMBER OF DAYS ________ HAVE NOT YET RESUMED SEXUAL RELATIONS .... 98 DON'T REMEMBER 99		

CHECK 208 LAST BIRTH STILL ALIVE YES 1 NO 2 → SKIP TO 501

LAST CHILD STILL BREASTFED [ ] ↓

LAST CHILD NOT STILL BREASTFED [ ] → SKIP TO 410

408. "How many times did you breastfeed last night between sundown and sunrise?"

NUMBER OF TIMES _____
CHILD SLEEPS AT BREAST 98

DON'T KNOW 99

409. "How many times did you breastfeed yesterday during daylight hours?"

NUMBER OF TIMES ______

MORE THAN TEN TIMES.98

DON'T KNOW 99

410. "At any time yesterday or last night was your last born child given any of the following:

READ LIST

	YES	NO
PLAIN WATER	1	2
JUICE	1	2
TEA	1	2
POWDERED MILK	1	2
COW'S OR GOAT'S MILK	1	2
ANY OTHER LIQUID	1	2
ANY SOLID OR MUSHY FOOD	1	2
NONE OF THESE	1	2

IF NOTHING APART FROM BREASTMILK GIVEN, SKIP TO 501, OTHERWISE. ↓

411. "Were any of these liquids given in a bottle with a nipple?"

YES 1 NO 2

704. Do you think a mother should wait until she has completely stopped breast-feeding before starting to have sexual relations again?

YES 1
NO 2
DON'T KNOW 3

705. Do you think that your husband approves or disapproves of couples using a method to avoid or delay pregnancy?

APPROVES 1
DISAPPROVES............2
DK 3

706. How often have you talked to your husband about this subject in the past year?

NEVER 1
ONCE OR TWICE..2
MORE OFTEN 3

707. In general, do you approve or disapprove of couples using a method to avoid or delay pregnancy?

APPROVE 1
DISAPPROVE 2
DON'T KNOW 3

708. How many children would you like to have in the whole of your life?

NUMBER _____
DK 99

END OF INTERVIEW
709. "That is all. Thank you for your help and co-operation in answering all these difficult questions."

CHECK 108 EVER MARRIED[ ] CHECK 204 NEVER MARRIED AND NO LIVE BIRTH [ ] ALL OTHERS[ ]

SKIP TO 709
END OF INTERVIEW

"Now I would like to ask you some questions about a different topic. Which of the ollowing ways for a couple to delay or avoid pregnancy have you heard about?"

	601"Have you ever heard of this method?"	602 "Have you & your husband or partner ever used this method?"	603 "Do you kno a person or pla where you can o or get advice o this method?"
PROLONGED ABSTINENCE) Couples may not have sexual intercourse for many months"	YES 1 ⟶ NO 2	YES 1 NO 2	
SAFE PERIOD) Couples can avoid sexual intercourse at certain times uring the woman's menstrual cycle"	YES 1 ⟶ NO 2	YES 1 NO 2	
(WITHDRAWAL) Men can be careful and pull out before climax."	YES 1 ⟶ NO 2	YES 1 NO 2	
(PILL) Women can take a pill every day"	YES 1 ⟶ NO 2	YES 1 NO 2	YES 1 NO 2
(IUD) Women can have a loop or coil placed inside them by a doctor or nurse."	YES 1 ⟶ NO 2	YES 1 NO 2	YES 1 NO 2
NJECTIONS) Women can have an injection which stops her from becoming pregnant r several months."	YES 1 ⟶ NO 2	YES 1 NO 2	YES 1 NO 2
IAPHRAGM, FOAM, JELLY) "Women can place a sponge, a ppository, or diaphragm, or lly or cream inside them before intercourse."	YES 1 ⟶ NO 2	YES 1 NO 2	YES 1 NO 2
ONDOM) en can use a rubber sheath during sexual intercourse."	YES 1 ⟶ NO 2	YES 1 NO 2	YES 1 NO 2
EMALE STERILIZATION) omen can have an operation to avoid having any more children	YES 1 ⟶ NO 2	YES 1 NO 2	YES 1 NO 2
NY OTHER METHODS) ave you ever heard of any other methods, including aditional ones that women men can use to avoid or delay pregnancy?" SPECIFY ______________	YES 1 ⟶ NO 2	YES 1 NO 2	YES 1 NO 2

IF NOT SINGLE 'YES' TO 601, SKIP TO 701.

CHECK 501 AND 602

PREGNANT [ ] (SKIP TO 607)

SHE STERILIZED [ ] (SKIP TO 709) END OF INTERVIEW

ALL OTHER [ ] ↓

604. Are you currently doing something to avoid or delay getting pregnant?

YES 1

NO ......2(SKIP TO 607)

605. Which method are you using?

PILL 01
IUD 02
INJECTIONS 03
VAGINAL METHODS ...04
CONDOM 05

SAFE PERIOD ....08 (SKIP TO 701)
WITHDRAWAL ....09 (SKIP TO 701)
PROLONGED ABSTINENCE ....10 (SKIP TO 701
OTHER ________________11 (SKIP TO 701)

606. Where did you (or your husband or partner) obtain (METHOD) (the last time you got supplies)?

GOVERNMENT HOSPITAL 1
GOVERNMENT HEALTH CENTER 2
CLINIC 3
PRIVATE HOSPITAL OR PRIVATE CLINIC 4
PHARMACY 5
FIELD WORKER 6
OTHER ________________ 7
(SPECIFY)
DK 8

→ NOW SKIP TO 701

FUTURE USE

607. DO you & your husband or partner intend to use a method to avoid or delay pregnancy at any time in the future?

INTENDS	1	
DOES NOT INTEND	2	(SKIP TO 701)
MUST CONSULT HUSBAND	3	
DK	4	

608. Which method would you prefer to use?

PILL	01	
IUD	02	
INJECTIONS	03	
VAGINAL METHODS	04	
CONDOM	05	
FEMALE STERILIZATION	06	
SAFE PERIOD	07	(SKIP TO 701)
WITHDRAWAL	08	(SKIP TO 701)
PROLONGED ABSTINENCE	09	(SKIP TO 701)
OTHER ________________ (SPECIFY)	10	(SKIP TO 701)
UNSURE	11	(SKIP TO 701)

609. Where or to whom will you go to get advice or supplies?

GOVERNMENT HOSPITAL	1
GOVERNMENT HEALTH CENTER	2
PRIVATE HOSPITAL OR PRIVATE CLINIC	3
PHARMACY	4
FIELD WORKER	5
OTHER ________________ (SPECIFY)	6

SECTION 7 FERTILITY PREFERENCES

SEE 109 & 204 AND CHECK:

CURRENTLY MARRIED AND WITH AT LEAST ONE LIVE BIRTH [ ]

ALL OTHERS [ ] (SKIP TO 707)

701. I now have some questions about the future.
CHECK 501:

NOT PREGNANT [ ]: Would you like to have another child or would you prefer not to have any more children?

PREGNANT [ ]: After the child you are expecting, would you like to have another child or would you prefer not to have any more children?

HAVE ANOTHER 1
NO MORE 2
UNDECIDED OR DK 3

702. What do you think is the best interval between the birth of one baby and birth of the next?

YEARS ________
UNDECIDED OR DK 9

703. For how long do you think a couple should wait before starting sexual intercourse after the birth of a baby?

NUMBER OF DAYS ______
UNTIL THE MOTHER
IS 'HEALTHY' 98
DON'T KNOW 99

SECTION 5 PREGNANCY

501. "Are you now pregnant?"

YES 1 NO 2 UNSURE 3

502. "For how many months have you been pregnant?"

MONTHS ________

DON'T KNOW __0__

503. "Since you became pregnant, have you had any injection to stop the baby from getting tetanus (convulsions)?"

YES 1 NO 2 DK 3

SKIP TO 506

504. "Do you have immunization card for this injection?"

YES 1 NO 2 DK 3

SKIP TO 506

505. "Please may I see it?"

SEEN 1 NOT SEEN 2

506. "When during her monthly menstrual cycle do you think a woman has the greatest chance of getting pregnant?"

DURING HER PERIOD	1
RIGHT AFTER HER PERIOD	2
IN THE MIDDLE OF HER MONTHLY CYCLE	3
JUST BEFORE HER PERIOD BEGINS	4
AT ANY TIME	5
DON'T KNOW	6

APPENDIX 2

Imputation Methods

If other methods of handling missing data such as dropping cases or variables with missing data are found to be unsatisfactory and if it is decided that imputed values be substituted for missing nonresponse, a number of methods ranging from purely ad hoc to ones involving strong distributional assumptions have recently been made available. In what follows, we present brief discussions of some of the most widely used metthods of imputation. Extensive discussion of most of the methods may be found in Sande, (1982); Kalton (1983), Little and Schluchte, (1985), Little and Rubin (1987) and Rubin (1987).

a) Deductive imputation: This is a method of imputation where missing values can be deduced with certainty or with high probability from other information in the record (Kalton, 1983). For instance, if the age of a mother at the time of ith birth is missing but the age of the ith child and the age of the mother at the survey are available, the age of the mother at the time of the ith birth can be determined by subtracting the age of the child from the age of the mother at survey. This method essentially depends on some redundancy of information collected and cannot always be used for imputing missing dates as such information is not always available.

b) Mean value imputation: This method is the simplest and most commonly used method of imputing missing values. The procedure involves the computation of means for variables with missing values from the available respondent information and filling the blanks by the mean values. In most cases, the sample is divided into imputation classes (strata) on the basis of some common criteria and means are computed for each variable with missing data from the respondent data in that class and the class means are substituted for all records in the class with a missing value for an item. For instance, if the age of a respondent is missing, the sample may first be divided into several imputation classes by such variables as literacy, residence, marital status, number of children ever born, etc., and the mean age can be computed for each class and this value can be substituted in place of the missing age of a person in that class.

However, the procedure is based on the assumption that the means for the respondents and nonrespondents in each class are identical. If it happens that the mean for the respondents is greater than the mean for the nonrespondents, the population mean would be overestimated and on the other hand, if the mean for the respondents is less than the mean for the nonrespondents, the population mean would be an under-estimate. Further, the procedure distorts the shape of the sample distribution by adding a large proportion of equal values and it leads to a lower variance and thus an unusually peaked distribution. It may also be pointed out that if the variable for which a value has to be imputed is a discrete variable like number of persons in a household or the number of children ever born by a woman, the imputed values will generally be an impossible non-integer values (say 3.5 persons in a household or 4.3 children born by a woman). Nevertheless, the method can be used when nonresponse occurs at random.

c) Use of past data: If a file is available from periodic surveys that collected similar information on the same units and if the values of the variable of interest is not expected to change over time, this file can be matched with the current survey file and the value of the variable from the former survey file may be substituted for the missing value in the current survey file. If the value of the variable is expected to change with time a projected value may be used. For instance, if a survey conducted ten years ago had collected information on age for the same person and if age is missing in the current survey, the current age may be obtained by adding 10 years to the age reported in the previous survey after matching the two files. Such a procedure is sometimes called a cold deck imputation method. The problem with this method however is that in most cases, surveys are based on random sampling and the same individual may not be included in the two independent surveys and consequently, cases are rarely matched.

d) Use of Models: If it is believed that there exist a relationship between variables, it may be possible to build a mathematical model using the respondent information and use this model to impute values for the missing variable (Sande, 1982). For instance, if variable **Y** is missing for some of the respondents and if it is known that there is a relationship between **Y** and a set of independent variables X_i (i=1, 2,...,-p), then a regression model of the form **Y = XB +E** where **Y** is a **nx1** vector, **X** is an **nxp** matrix, **B** a **px1** vector of coefficients and **E** an **nx1** vector of residuals can be developed using the available information on **X** and **Y** assuming that there is no response bias in **Y** given **X**. Both **X** and **Y** can be quantitative or qualitative variables. If some of the **X**'s are qualitative, these can be incorporated into the model using a dummy variable technique. On the other hand, if **Y** is qualitative, log-linear or logit regression procedure can be employed (Kalton, 1983). Then the missing **Y** can be predicted using the available **X**s for that record and this value can be substituted for the missing value.

As Sande (1982) and Kalton (1983) report, although modelling is mathematically sound and may reduce bias in the estimation of means and totals, it has some shortcomings. First, achieving a good fit can be time consuming and difficult. Second, as the procedure does not take the edit structure into account, the imputed values may fail edit checks. Third, the method is based on the usual assumptions of regression techniques (normality, homoscedasticity, etc.) which are not always correct. Hence, it seems unrealistic to consider its application to all items with missing values. However, it may be applied on a few major variables for which effective linear models can be developed with a high correlation coefficient. Further description of regression procedures for imputing missing values may be found in Schieber (1978) and Herzog and Lancaster (1980).

e) Hot deck Procedure: This procedure begins by specifying imputation classes and the assigning of a historic or ad hoc value to each imputation class. This value is used as a starting point for the procedure. It treats the records of the current survey sequentially and replaces the value stored for the imputation class by the value of the item in the current record if it is available. If a value in the current record is not available, it imputes a value from the donors in that class and replaces the missing value by this value. If there is no value that can be accepted, the procedure retains the value stored for its imputation class at the beginning of the procedure.

The procedure, unlike the cold deck procedure, uses the current survey respondents as donors. Also it is computationally simple as the imputation is done in one pass through the data file. However, it can give rise to multiple donors, that is, if a record is followed by one or more records with missing value for an item, all these records are assigned the value of the last record in the imputation class. Further, it can impose limitations on the number of imputation classes so that one or more donors are found for each class containing a record with a missing value for an item (see Kalton, 1983; Sande, 1982).

A modified version of this method called the flexible matching imputation was developed to overcome some of the shortcomings of the traditional hot deck procedure. This procedure begins by matching donors with recipients on a sizeable number of control variables. The matching is done hierarchically, that is, if no donor can be identified to match a recipient on all the control variables, some of the variables that are considered less important are dropped or their details of classification reduced (Kalton, 1983). The Method avoids the use of multiple donors. It also enables far closer matches to be secured for many recipients. It was implemented and evaluated by Coder (1978) and Welniak and Coder (1980).

f) Other Methods: Methods such as distance function imputation in which matching is done on quantitative control variables and forming imputation classes, or random imputation in which donors are selected by some form of probability sampling within an imputation class can also be used in assigning values to missing variables (Kalton,1983).