INFANT AND EARLY CHILDHOOD MORTALITY IN SHEWA REGION AN INVESTIGATION INTO THE LEVELS AND DIFFERENTIALS

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Infant and Early Childhood Mortality in Shewa Region: An Investigation into the Levels and Differentials

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SHEWA IN ETHIOPIA
ERITREA
RED SEA
SUDAN
GONDER
TIGRAY
WELO
DJIBOUTI REPU
GULF OF ADEN
GOJAM
WELEGA
SHEWA
SOMALIA
ILUBABOR
HARERGE
ARSI
KEFA
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GAMO GOFA
BALE
SIDAMO
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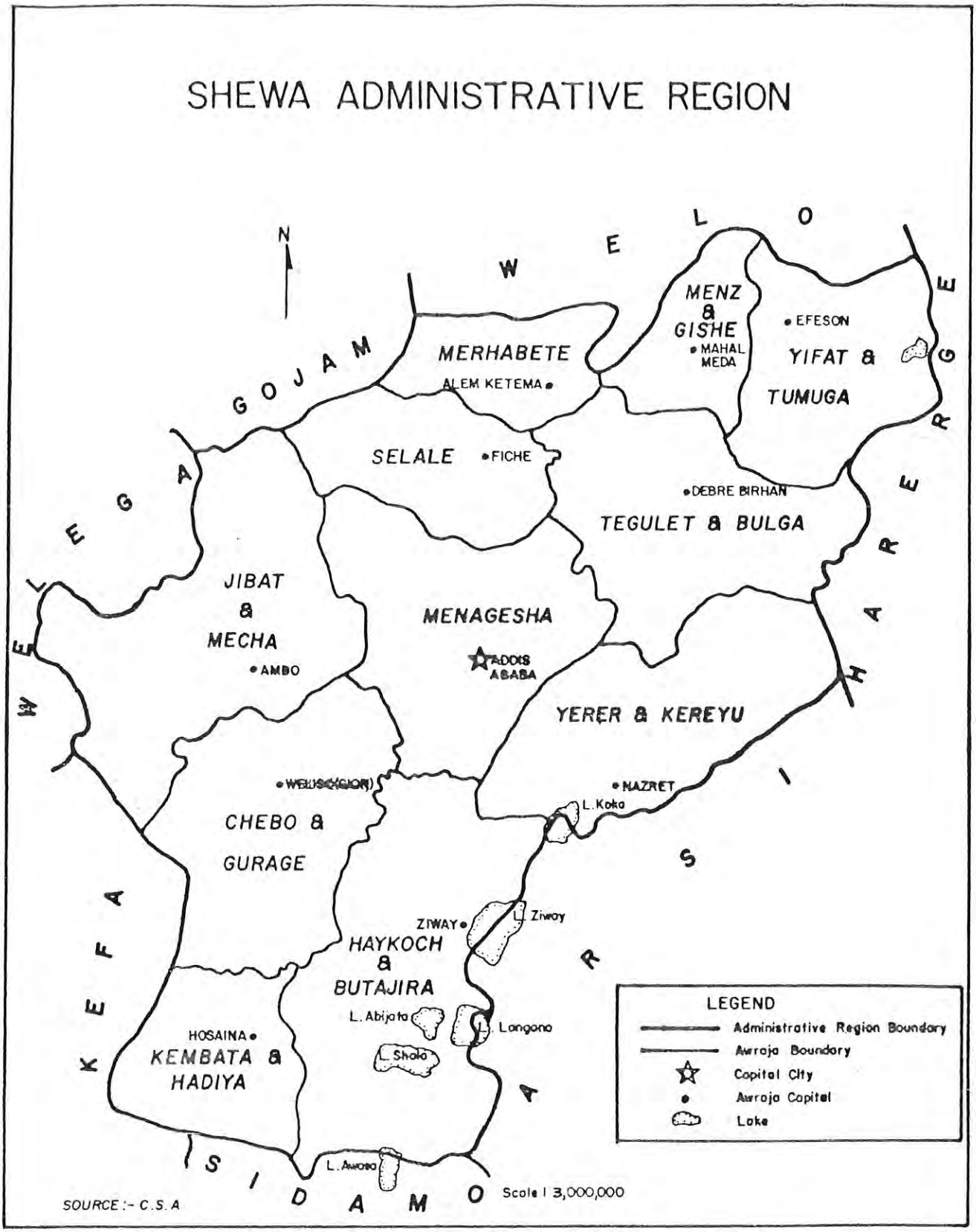
SHEWA ADMINISTRATIVE REGION
N
WELLEGA
GOJAM
WELLO
HARERGE
MERHABETE
ALEM KETEMA
MENZ & GISHE
MAHAL MEDA
EFESON
YIFAT & TUMUGA
SELALE
FICHE
DEBRE BIRHAN
TEGULET & BULGA
JIBAT & MECHA
AMBO
MENAGESHA
ADDIS ABABA
YERER & KEREYU
NAZRET
L. Koka
WELISO(GION)
CHEBO & GURAGE
ZIWAY
L. Ziway
HAYKOCH & BUTAJIRA
L. Abijata
Langano
L. Shala
HOSAINA
KEMBATA & HADIYA
L. Awasa
KEFA
SIDAMO
ARSI
LEGEND
Administrative Region Boundary
Awraja Boundary
Capital City
Awraja Capital
Lake
SOURCE :- C.S.A
Scale 1 3,000,000

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Abstract

Available evidence show that not only is child mortality in Ethiopia among the highest in the world, there are also considerable differences in chances of survival among children of different population groups. Nevertheless, the different aspects of child mortality are still far from sufficiently documented. In an effort to fill some of the gaps in this respect, this study sought first, to determine levels and trends of child mortality using a 5 percent sample of women from the 1984 census data for Shewa region. Because of its cultural and climatic diversity, Shewa provides an ideal setting for such an undertaking. Second, attempt was also made to find out the differences in child survival in a uni- and bivariate study followed by a multivariate analysis of the determinants of child mortality.

Using the Trussell procedure, infant mortality rate (IMR) is estimated as high as 101 deaths per 1000 live births for Shewa region. The corresponding child ($_4q_1$) and under five mortality ($_5q_0$) are 73 and 167 respectively. This means that one out of every six children in the region fails to reach his/her fifth birthday. Furthermore, no improvement in child mortality in the recent past is detected. In the 1970s it remained constant fluctuating around 160 deaths per 1000 live births for both sexes.

When attention is focussed on the differences in child mortality among different population subgroups, the expected strong negative relationship between child mortality and education of mother is evident. One revealing aspect of this study is the prevalence of strong regional difference in child mortality in Shewa region. Thus, the incidence of child death is much more frequent in the three southern Awrajas of Haikoch-Butajira, Kembata-Hadiya and Chebo-Gurage than in the central Awrajas of Menagesha, Selale and Tegulet-Bulga. Moreover, child survival advantages of the Amara ethnic group over that of the Gurage, Christians over Moslems and the currently married women over other marriage categories are observed.

It emerged from the study that acquiring more pertinent data, expanding educational opportunity for women, redressing the regional imbalance in child mortality will go a long way in reducing child mortality in this country.

CHAPTER ONE

INTRODUCTION

1.1 Issues and Problems

Demographers and medical experts alike have devoted special attention to infant and child mortality in comparison to any other segment of mortality. There are justifiable reasons for such apparent focus of interest. The total number of lives lost up to early childhood (age five) is immense. In most Less Developed Countries it constitutes a bigger share of the aggregate level of mortality. In fact, it is this component that raises the crude death rate in these countries. If the loss of life which is mostly caused by preventable exogenous factors is measured in terms of the number of years lost, the nature of the problem becomes even more evident. For this reason mortality in early life, quite often, is regarded as a crucial test of the health services and social progress of a country (Cox, 1979).

Available evidence show that in spite of the steady decline in the second half of this century, infant and child mortality remain still high in most developing countries with sub-saharan Africa having the highest level. According to the United Nations (1985) about three quarters of all deaths in Less Developed Countries to persons under age 30 could be expected to occur under age five. A third of all deaths in Kenya in the early 1980's occurred among children below age five (cited in Kibet, 1987:146). Similarly, 20 percent of the children in Egypt in 1984 (Hamed,1987) and

over 15 percent in Nigeria (Ogunlade and Mezue, 1987) failed to survive to their fifth birth day.

In contrast, estimates for the more developed regions indicated that only less than 2 percent (19 per 1000 live births) failed to survive to exact age five in 1980-85 (UN, 1990b: 154). In other words, more than 98 percent of the children survived through the pre-school years.

Ethiopia, designated as one of the 41 least developed countries of the world, was not only reported to have had one of the highest levels of childhood mortality, it even appeared to have deteriorated between 1970-75 and 1980-85 reportedly as a result of famine (UN, 1990b). Although divergent estimated levels are observed among the few studies pertaining to infant and childhood mortality, they all point to a fairly high level. One study commissioned by UNFPA in 1984 put the level of mortality under five years of age at one-half of the total deaths in the country (Genet, 1987). Other studies based on the 1981 rural demographic survey (eg Kassahun, 1986) came up with an estimate of about a quarter of all deaths to ages under five years. In a multi-purpose survey conducted in the central regions of Shewa and Arsi, in the spring of 1986, Blacker (1986) estimated 190 under five deaths per 1000 live births.

Apart from being high, there is another distinct feature of infant and child mortality in LDCs. Numerous studies point to the existence of considerable difference

in the survival chances among children belonging to different population sub-groups. There is a growing consensus that these differences are nothing more than reflections of differences in other, broadly described, socio-economic factors. The implication of this assertion should not be lost on the reader.

Even though levels of infant and child mortality in Africa are very high, they have not been quantifiably documented in sufficient detail. Other than the general scarcity and spurious nature of the data which is too well known to merit any discussion here, the methodological issues involved in analysing even the existing data were some of the major bottlenecks behind the meager effort made so far. The Brass-type indirect techniques of estimating child mortality from limited data, which is the more appropriate method with many African data was developed recently. Although it is now widely used, there was initial misgivings as a result of some inconsistencies detected in the method, one notable feature being that q(2) was found to be greater than q(3). The inconsistency persisted even after refinements were incorporated into it (Blacker,1979). The method of analysing the determinants of child mortality in a multivariate regression analysis developed by Trussell and Preston (1982) was even more recent.

In Ethiopia, where the data situation has been even more precarious, both in terms of quality and quantity, than in most African countries, a comprehensive and systematic study of infant and child mortality has yet to be undertaken as previous

attempts in this regard were limited. While the primary preoccupation of the Central Statistical Authority had been to collect data of demographic and socio-economic nature, more recently attempts are being made to analyze the collected data. However, mortality in general and infant and child mortality in particular are not yet given much attention by the Authority.

Nevertheless, few studies on the levels and differentials of infant and child mortality were made. A couple of studies (Kassahun, 1986; Genet, 1987) were based on the 1981 Rural Demographic Survey. Another by Zewdu (1987) which was a study of one zone in Addis Ababa was based on the 1984 national census for the city. A study by Tesfayesus (1985) utilized primary data i.e., a survey conducted by the author himself between late 1976 and early 1977 in two rural localities of Mettu and Alemaya as well as the city of Addis Ababa. In a multi-purpose study, Blacker (1986) used both his own survey conducted in the spring of 1986 and a series of surveys carried out by the CSA in the early 1980's.

One common strand of the foregoing studies is that they are all, except the one by Zewdu (1987), essentially univariate studies. Because of the synergic effect among the variables that are believed to affect child mortality, the solitary impact of each is difficult to gauge with a credible degree of confidence in a univariate study. So the need is felt for a more ~~through~~ thorough going approach and using the latest available data.

1.2 Definitions

Infant mortality comprises deaths occurring during the first year of life i.e., from birth to exact age one. It is measured by Infant Mortality Rate (IMR) which is defined as a ratio of the number of deaths of infants (under one year of age) to the number of births in a calendar year (Logan, 1953). Due to its definition, since it shows the rate of death of new born babies, it is in fact the probability of dying and is commonly denoted by q_0 or ${}_1q_0$ according to the notation commonly used in the life table. Early childhood mortality (${}_4q_1$), on the other hand, measures the risk of dying between exact ages of one and five years. Put in another way, it measures the number of children who fail to survive to their fifth birthday out of the initial 1000 cohort members at exact age one.

With respect to the first index, a mismatch arises between the number of deaths and number of live births. The deaths in a calendar year include some of the births in the previous year and only part of the births in the year of interest. Therefore, if fluctuation in the annual births is great, the accuracy of the index is jeopardized. So caution is required in the comparison of the levels of various populations.

Because of the nature of the available data and the consequent method adopted, "Infant and Early Childhood Mortality" in this study refers to the combined

mortality risk of a child between birth and various ages up to five years (${}_nq_0$, where n=1,2,3,4,5). This last index does not suffer from problem of incompatibility between numerator and denominator mentioned above, and hence it can freely be compared across different populations.

1.3 **Review of Selected Literature**

A growing body of literature has documented many aspects of infant and child mortality. A recently proposed epidemiological transition theory (Omran, 1971) viewed mortality as the principal factor in population dynamics. In the transition stage, where most of the developing countries now belong, side-by-side with the reduction of mortality, the pattern of morbidity also gradually shifts from infectious to degenerative or man-made diseases. The theory holds, among others, that children specially between ages of one and five years as well as young women are the main beneficiaries in this change and concomitant improvement in health and mortality.

Despite some improvements in the level of mortality of the population at large, infant and child mortality still remain high with sizeable variation in chances of survival among children belonging to different population groups. Understanding this difference is the obvious point of departure in any effort aimed at reducing infant and child mortality. Of late, the development of more appropriate techniques and the availability of computer facilities has enabled researchers to channel more and more

efforts in isolating the degree of influence on child mortality of each of the socio economic variables which usually work in synergy.

Spurred by advances in medical science in the early days, efforts to combat the alarming infant and child mortality in the developing countries took the form of biomedical approach to the exclusion of social factors. When numerous instances of the clinical success stories of the health system could not be replicated in the community at large (Mosley, 1984) an awareness developed about the significance of the socio economic dimension as well. By bridging the gap between the biomedical and socio economic factors the analytical framework proposed by Mosley and Chen (1984) facilitates the study of child mortality differential.

Sifting through the literature one detects unmistakable general pattern of mortality differentials by socio economic factors in all populations. But still, the magnitude and sometimes the direction of the relationship of some variables could be different for different populations. This is mainly the result of interaction among a mosaic of cultural, economic, geographic and other traits which could form the basis for specific policy measures tailored for specific conditions.

1.3.1 **Maternal Education and Child Mortality**

The negative relationship between parental education especially maternal on

the one hand and infant and child mortality on the other, is now supported by many studies in a widely different populations. The education of mother has strongly and consistently emerged as an important variable with inverse relationship to infant and child mortality. In most cases, the association persists even after controlling for other related factors.

In a pioneering and widely cited work, Caldwell (1979) and later, using World Fertility Survey (WFS) data, Ogunlade and Mezue (1987) have presented evidence from Nigeria that female education played a major role in determining the levels of infant and child mortality in developing societies. Studies along similar line in the Sudan (Farah and Preston, 1982; Mohammed, 1987) and using WFS data in Kenya (Kibet, 1987) have all documented the expected negative relationship. Controlling for the place of residence, findings in Ghana (Tawiah, 1979) accord with the above results. The powerful association is also confirmed by findings in Latin America (Behem et. al., 1980), in many developing countries (Chochraine et al., 1980) and in Punjab, India (Das Gupta, 1990). One particular survey in two provinces of northern Thailand (Franzen and Hogan, 1982), however, did not exhibit any significant effect of maternal education on infant mortality. In the Ethiopian context, in spite of the different schemes of classification and different temporal and spatial variation, the inverse relationship described in the foregoing is indeed reported (Tesfayesus, 1985; Blacker, 1986; Kassahun, 1986; Genet, 1987; Zewdu, 1987).

Many of the studies mentioned above and others (eg Gortmaker, 1979) have also found a decrease in infant and child mortality with increase in paternal education. But the relationship was weaker in comparison to that found with education of mother. While some authors (eg Farah & Preston, 1982) regard father's education as a proxy for household income, others (eg Kibet, 1987) suggest that it exerts more important effect on its own. It appears that the impact of paternal education is inconclusive.

The mechanism through which increased maternal education works to bring about a decline in child mortality is not that clear, however. One argument is that the mother's education raises her skill of child care specially in connection with health and nutrition (Das Gupta, 1990; Ogunlade and Mezue, 1987). According to Caldwell (1979) maternal education also enhances her status and hence her decision-making capability in a strongly patriarchal societies which in turn would allow her to alter traditional family relation in favour of children rather than adults. There is evidence of the status (woman's autonomy) explanation from the Das Gupta (1990) study. Controlling for crudely defined status variable in Khartoum did not, however, attenuate the influence of maternal education on child mortality (Farah & Preston, 1982). It is also argued that the observed lower infant and child mortality for educated/literate mothers could be due to higher income generated by assortive matings with educated husbands (Shultz, 1984; Farah and Preston, 1982).

If education exerts the degree of impact implied by the various studies, this would suggest it may act as a complement to health care services.

1.3.2 Work Status of Mother and Child Mortality

The focus here is on two categories of women; housewives (considered as economically not active) and working mothers. It is implicitly assumed that the place of work is different from home. The hypothesis usually tested is that children of working mothers experience higher mortality than children of non-working mothers. Children whose mothers work outside are likely to suffer neglect and breast-fed less as the mothers stay away during the working periods.

This variable is quite difficult both to handle and interpret (Ware, 1984). Unlike educational status which remains fixed once acquired, the work status of women can change quite often. In addition, to test the hypothesis effectively a western type concept of employment, where an employed person would strictly stay in his place of employment, is required.

The validity of the hypothesis appears to be mixed at best. In the analysis of data from 15 developing countries (seven in Africa, five in Asia, three in Latin America), the UN (1985) found out that in eleven of them children of non-working mothers had below average child mortality level. Mortality level of children of

working mothers was raised by 27% in Khartoum and 10% for the whole Sudan compared to non-working mothers (Farah & Preston, 1982). Based on the 1970 census data for Thailand, Knodel and Chainratrithirong (cited in Frenzen and Hogen, 1982) also concluded that working mothers experienced higher infant mortality than non-working mothers. The possibility of reverse causation i.e., mothers who lost children are freed from child care and hence are likely to get employed, is also strong.

On the opposite side of the spectrum the reverse appears to be the case in Kenya (Kibet, 1987) and Nigeria (Ogunlade and Mezue, 1987). In rural localities of Mettu and Alemaya (Tesfayesus, 1985) children born to the economically active mothers had a better chance of survival than those born to the economically less active. In Addis Ababa, the reverse was the case.

In the African setting the explanation is advanced (Kibet, 1987; Ogunlade and Mezue, 1987) that women working outside might be better educated and have higher income. In addition, it is a common practice in many parts of the continent for grand parents and mother substitutes to take the place of the real mothers at any stage of the child rearing process. The concept of labour force participation is rather fluid in this part of the world. Peddling items a short distance away from home would hardly conflict with her child-rearing activities. As Ware (1984) correctly pointed out, it is not so much the type of employment *per se*, but the manner of employment of mother

that should count. Hence the result largely remains inconclusive.

1.3.3 Urban-Rural residence of Mother and Child Mortality

The seemingly apparent lower mortality in the urban than in the rural settings which is now a feature of most developing countries, had not been true of cites in Europe in the mid 19th century (UN, 1973:132-6). The concentration of medical facilities, higher income, better educational opportunity and safer water supply are some of the major factors contributing to lower child mortality in urban than in rural areas (Tawiah, 1979; Farah & Preston, 1982; UN, 1985; Kibet, 1987; Ogunlade and Mezue, 1987). The less tangible 'urban milieu' also facilitates the use of the above mentioned advantages. Once education and income were held constant, however, the urban-rural difference became negligible (Caldwell, 1979; UN, 1985). In an OLS multiple regression analysis of the Egyptian contraceptive prevalence survey, urban-rural residence of the mother emerged as the most important variable in explaining changes in child mortality (Hamed, 1987). In a multi-purpose survey in Shewa and Arsi regions of Ethiopia, Blacker (1986) reported lower proportion of dead children in urban than in rural areas.

Some studies, however, reported conflicting evidence. In Tanzania, for example, mortality was estimated to be higher in the capital city Dar-es-Salam than in other urban areas although the phenomenon was ascribed to more complete

registration of deaths (Hogan and Jiwani, cited in UN, 1985).

1.3.4 Region of Residence and Child Mortality

A related but more intriguing result is the geographic differential of mortality in the same country. The pattern of variation in the less developed countries appear to be different from that in developed regions where the geographic variation may simply reflect the geographical distribution in socio economic factors (UN, 1973:136). There are indications that in the Less Developed Countries regional differences in child mortality are not entirely explained by socio economic variations alone (UN, 1985). Thus the incidence of child mortality was more severe in the southern than in the northern region of Sudan (Farah & Preston, 1982). In Egypt the Upper Governorate, had higher child survival than Lower and Upper Egypt (Hamed, 1987). In Kenya, the Rift-valley and Central Provinces exhibited lower incidence of infant and child mortality (Kibet, 1987). Findings by the UN (1985) indicate the existence of modest to substantial regional variations in mortality among a group of 11 developing countries.

On the whole, the climatic-ecological condition along with the associated disease environment (especially malaria in Africa) was suspected to be the major culprit in the variation.

1.3.5 Woman's Place of Birth and Mortality

The route through which woman's place of birth affects the mortality of her children at later years is not apparent. The explanations advanced are speculative. The argument (cited in Farah & Preston 1982) that the place of birth could have an impact on the physical development of the would be mother during the formative years of her life is rather plausible. It is also argued (Farah & Preston, 1982) that urban birth might produce the added advantage of familiarity and easier access to social and health services. The authors have shown women born in Greater Khartoum had 26 percent lower mortality among their children than women born in villages, controlling for their social class origin. A comparative univariate and multivariate study by the UN (1985) confirm that rural childhood residence of the mother indeed increases the risk of infant and childhood mortality. Coming nearer home, in zone one of Addis Ababa, a slight edge of survival for children of women born in Addis Ababa against those born outside was reported (Zewdu, 1987). When education was controlled the advantage of being born in Addis vanished lending support to the hypothesis that place of birth works primarily through other socio economic variables like education. Clearly the issue merits further investigation.

1.3.6 Marital Status and Child Mortality

Although the relationship between mortality and marital status has long been

a subject of interest, evidence regarding particularly the relationship between marital status and child mortality is scanty. It is generally believed that children of currently married persons fare better chance of survival than children in any other marriage category. The host of explanations include that the termination of union either by death of spouse or dissolution of marriage would increase the economic hardship on children of broken family (Behm, 1983). Data analysis by the UN (1985) for 14 countries indicate that married women in general had lower child mortality than widowed and divorced. The same study, however, noted a different result for three countries (Chile, Kenya and Liberia) where the mortality level for the children of single women was lower than average. This category was examined only by the three countries. Some of these discrepancies could arise from variation in definitions.

In zone one of Addis Ababa (Zewdu, 1987) and Gonder region (Genet, 1987) married women experienced lower child mortality than all other marriage groups. In the former, the singles reported slightly lower child mortality than the widowed, divorced and separated.

1.3.7 **Religion, Ethnicity and Child Mortality**

Evidence from available sources indicate the existence of significant difference in infant and child mortality among religious and ethnic groups. Nevertheless, coherent explanations for the observed difference is rather scanty. There is growing

consensus, however, that the difference could be a mere reflection of other differences in socio-economic factors. A considerable mortality gap between Christians and Moslems was observed in Nigeria with Moslem children 50 percent more likely to die than the Christians (Ogunlade and Mezue, 1987). It was hypothesized that the above result was because of the better education received by Christians on the average. When education of mother was controlled, no clear cut difference was observed supporting the above contention. In zone one of Addis Ababa, Protestants and Catholic children together were found to have better survival chance than the Orthodox Christians and Moslems (Zewdu, 1987). For rural Ethiopia, Christians had lower child mortality than their Moslem counterparts (Kassahun, 1986).

In the UN (1985) comparative study of child mortality, four countries (Ghana, Kenya, Nigeria and Sierra Leon) for which comparison could be made, demonstrated that Moslem mothers had significantly higher infant and child mortality than Christian mothers. In a bivaraite analysis more education did not appear to eliminate the above difference.

Although the criteria of categorization used for ethnicity are different (eg racial, linguistics, cultural, etc. or some combination of these) a substantial variation in child loss across ethnic groups in eleven developing countries was observed (UN, 1985). Unlike in the case of religion, the disparity could reflect variation in an innate

On the contrary in Kenya, a slightly higher child survival of females was attributed to the bride price girls bring to the family (cited in Mosley & Chen, 1984). In Ghana (Tawiah, 1979) male infant mortality was found to be higher by 23 percent and child mortality by 12 percent. In northern rural Thailand no significant difference was observed (Frenzen and Hogan, 1982).

Evidence from Ethiopia does not appear consistent in this regard. Tesfayesus (1985) and Kassahun (1986) reported higher survival advantage for female infants and children. On the other hand, in Hararge and Gonder (Genet, 1987) there was no statistically significant difference in survival chance between male and female children.

1.4 Significance of the Study

This and similar studies could be used as a stepping stone for further research in the field. The significance of the study of child mortality differentials is aptly described elsewhere (UN, 1985:1)

> "First, such studies provide information for assessing inequalities among people with respect to longevity and health. Second, data on mortality differential help to identify those under privileged segments of the population who experience higher mortality levels. These groups are an appropriate target of policies and programmes for improving health conditions and survival chances.

Finally, studies of mortality differentials improve our understanding of determinants of mortality and their interrelationships, on the basis of which proper policy measures for reducing mortality are developed, selected and improved."

Apart from the public health significance of the study of child mortality, its strong association with fertility adds another dimension to its importance.

1.5 The Objective

The purpose of this study is to analyse the levels, trends as well as univaraite and bivariate differentials of infant and child mortality for Shewa region using the 1984 national census data. This aspect of the study will allow the examination of previous results in light of our new findings. Unlike all the previous studies, however, the present study intends to take the whole analysis one step further. It aims to determine the relative importance, the magnitude and direction, of each variable in explaining changes in child mortality in a multi-variate framework. More specifically the objectives are:

1. to estimate the levels and trends of childhood mortality for Shewa region.
2. to investigate infant and child mortality differentials according to one demographic and some socio-economic factors.
3. to assess the determinants of infant and child mortality in a

multivariate framework.

The main thrust of the study is on child mortality differential by one demographic and some socio-economic variables such as sex of child, education of mother, work status of mother, urban-rural residence, region of residence, mothers place of birth, marital status, religion and ethnicity of the mother. Questions related to birth order of the child, birth spacing illegitimacy, birth weight, type of union or exact date of birth and death were not asked in the census. One can therefore say that it was the available data that dictated both the choice of the variables and the method of analysis.

On the other hand, investigation of the linkage between fertility and child mortality has been excluded from the study on the grounds of technical problem. Both parity, the only proxy variable for fertility in our data, and proportion of children dead are also positively associated with the age of children. Higher parity women tend to have older children who in turn face longer exposer to and hence higher risk of death. Therefore, the positive association observed between parity and proportion of children dead, as shown later in Table 3.1, is reinforced by variation in age of children in the same direction. Since the existing data and analytical framework do not permit to control this intervening variable, the examination of the net effect of fertility on child mortality is not possible.

Although the original intention was to study the mortality situation for the whole country using the 1984 census data, the idea was abandoned since the country data were not yet officially released. Under the circumstances, Shewa was selected as the study area. Because of its population size, ethnic, religious and climatic diversity, Shewa, more than any other region epitomizes the main features of the country.

Hypotheses

In this study a detailed examination into the validates of the following hypotheses are carried out.

- A rise in the education level of a mother reduces the risk of death of her children
- Children of working mothers are likely to experience higher mortality than children of non-working mothers
- Chances of child survival could be higher among Christians than among Moslem families
- Rural birth of mothers increases the risk of infant and childhood mortality
- Children of currently married women could have lower mortality than children of widowed, divorced or separated mothers
- Female children might experience excess mortality than their male counterparts
- Urban residence of mother reduces the risk of child mortality

- Child mortality is likely to be more prevalent in Oromo than in Amara or Gurage ethnic groups
- Probable regional variation exists in risk of child death.

1.6 Source of Data and the Methodology Used

1.6.1 The Data

This study is based on data from the Population and Housing Census of Ethiopia for Shewa region conducted in may 1984 which was the first of its kind in the country. A 5 percent sample or 80,528 women between ages 15 and 49 years were selected for this purpose. Initially, a sample of 81,632 women were chosen out of which 1104, mostly in the urban areas, were visitors whose records were not complete. With the exclusion of these women our final sample consists of 80528 women.

Before the selection of the sample, women in the above age bracket numbering 1,632,658 with their associated population characteristics were first extracted from the total population of the region. Inclusion of some housing characteristics and other segments of the population like husbands was not possible because of cost, time and facility problems arising out of the sheer size of the data (more than 8 million records).

A study of child mortality differential by many variables, which is the main

thrust of this study, requires a proportionate territorial and age distribution of the population under study so as to capture all the main characteristics observed in it. The procedure of stratified random sampling is believed to ensure such a distribution. Under this technique the population of the region was first stratified by 11 administrative categories called *Awrajas* (provinces) each of which form a stratum. A simple random sample from each *Awraja* (stratum) proportional to size in each age group was then independently selected to get the required sample. The same 5 percent sampling fraction was used in all *Awrajas*.

The Population and Housing Census was not specially designed for child mortality analysis. Rather, like most censuses it tried to address a broad, but carefully balanced demographic and other socio-economic issues. Obviously, this provided only a limited opportunity for the study of child mortality differential.

In the census two types of questionnaires were served, one for the urban areas and the other for the rural, the difference being that the former includes detailed information on housing units. As far as coverage was concerned, only a nomadic population, accounting for less than one percent of the total population of the region, was not covered by the census (OPHCC, 1989).

Two sets of questions pertaining to infant and child mortality were asked. One was about the number of deaths and the associated characteristics such as age and

sex in each household during the previous 12 months prior to the census. The second involved asking each woman 10 years and over about the total number of children and the number of children dead that each women has had. Because of reasons that are explained in the next section data generated from the first set were severely under reported (OPHCC, 1989). In this study, therefore, data obtained from the second set of questions are used in the subsequent analysis. Each women 10 years and above was asked about the number of children born alive (1) living at home (2) living else where (3) dead. Together, the three questions provided the required data on proportion of dead children and parity. By focusing attention both on children present and those absent this combination of questions, it is believed (UN, 1990a), leads to lower omission cases in comparison with other direct questions on number of children ever born and those dead or alive.

1.6.2 Methodology of Study

The method of estimation and analysis adopted are, to a large extent, dictated by the type of available data. As it was explained earlier, the data that is required for the estimation of child mortality directly is grossly under reported while the more complete available data cannot be used as an input in the conventional (direct) method of estimation. The crude death rate (from current deaths) given for Shewa region, for example, was 9.2 deaths per 1000 population (OPHCC, 1989) which was on par with many low mortality populations. Even allowing for differences in the age

structure, this does not paint a realistic picture. There are several reasons that contribute to the under reporting of current deaths (deaths in the last 12 months). People in many parts of the world are usually reluctant to talk about deaths, regarded as repugnant and wish to forget about it. It is also argued (UN, 1983) that a death in the household might bring the disintegration of the household with no one to report the death(s) following the disintegration. The reference period error is one major reason. So because of these and other reinforcing factors, data generally obtained from current deaths in the census, by the experience thus far, have been unsatisfactory.

The impasse as a result of the foregoing bottlenecks led to the development of an indirect method of estimating child mortality by William Brass (Brass and Coale, 1968). In this method, child mortality is estimated from children ever born and children surviving out of those ever born. It uses data that are relatively easy to obtain and its reliability is generally acceptable (UN, 1990a:13). Indeed, it is believed that the Brass method is the only procedure which provides relatively reliable estimates of childhood mortality in many populations today (Sullivan, 1972). By avoiding the need for a reference period, the Brass method circumvents one of the major obstacles in the estimation of child mortality. This method has undergone through some refinements in the last few years. The Trussell version (1975) of the method is used both in the estimation of the levels and trends of child mortality in Shewa region.

In the second stage of the analysis a multivariate analytical technique mainly Ordinary Least Squares regression method is utilized to ascertain the magnitude of the effect of each determinant of mortality. In a comparative study by the UN (1985), using Peruvian data, the OLS regression method performed as well as the more sophisticated and more expensive Logit regression. Final results were also consistent. Therefore, from the point of view of the nature of the data, its modest resource requirement, simplicity and satisfactory performance, the OLS regression method is used in the analysis. The regression is done in three successive stages (equations). In the second and third stages more variables, in addition to the already existing are included. The third equation includes all variables. Then, by removing the *Awraja* variable, a fourth equation (stage) is added for the urban subsample.

In all stages of the analysis, the selection of a fixed mortality schedule which fits the population under study is required. In a country where the age pattern of mortality is not, to any reliable degree, known the choice of an appropriate mortality model poses a Problem. Since the Trussell version of the Brass method which is selected in our analysis is based on the Coal-Demeny life table system, our option is narrowed down to the use of this system. In addition, whatever little study there is in this country is based on the Coal-Demeny system of model life tables and hence facilitates comparison of results. Moreover, the UN models are less differentiated at younger ages than the Coal-Demney model (UN, 1990:10).

According to the UN (1983), the North model of the Coale-Demney system is considered more suitable for a society that breast feeds for more than a year as is the case in the study area. An empirical finding by Clairin (1968) for mortality under five years also point to the North model that best agrees with the observed data in Sub-Saharan Africa. Tesfayesus (1985) showed that the North model depicted the mortality pattern better in his study areas of the city of Addis Ababa, and rural localities of Mettu and Alemaya. Furthermore, when the probability of dying between exact ages of one and five years ($_4q_1$) was plotted against infant mortality ($_1q_0$) for some 18 developing countries (from WFS data), the neighboring country Kenya data was closely approximated by the North model in the Coal-Demeny System than by any of the five models in the United Nations model life table system (UN, 1990a). Although Ekanem and Som (1984) caution against the use of a predetermined model, their conclusion was based on general mortality data. Since the data in this study pertain to younger children the Ekanem and Som conclusion may not exactly apply to our data set. Hence the choice of the North mortality model.

1.7 Limitations of the Study

The following conceptual, methodological and data limitations should be taken into consideration when results of the analysis are interpreted.

1. Indications of omission errors of children especially dead children are detected in the data set. The effect of this is to lower the estimated level of mortality. In the

1.8 Plan of the Study

The study is organized in six chapters. Chapter one, which is the introduction, discusses issues and problems connected with child mortality and reviews some selected literature variable by variable. The objective of the study, the formulated hypotheses, the source of data as well as the methods and batteries of techniques utilized all along the line are provided in this chapter.

In chapter two, the general background of the study area is presented. It describes the population characteristics as well as the geography and economy of Shewa region. Attention is then focused, in chapter three, on the estimation of the levels of mortality using the Trussell and Sullivan versions of the Brass method. Trends of child mortality, if any, in the few years preceding the Census are established by using the Coale and Trussell procedure in the same chapter.

The difference in child mortality among various population sub-groups are examined in chapter four which essentially consists of a uni- and bivariate comparison of proportion of dead children for different categories with in the same variable.

Chapter five examines the determinants of child mortality in an OLS regression analysis. The importance of this chapter in the study cannot be over emphasized. This is where the relative importance of each variable vis-a-vis child

mortality assessed. This study finally winds itself in a brief chapter six, where the different results and findings are summarized and recommendations made.

academic secondary schools (CSA, 1986). In addition to the health and educational facilities found in the region, it also stands to gain more than any other regions from the improportionately higher concentration of various facilities in Addis Abeba. The proximity of the market in Addis Abeba to the region serves as an outlet to the agricultural produce of the region and easier access to manufactured commodities.

More than 85 percent of the population of the region is engaged in agriculture. Although land was distributed to landless peasants in the mid 1970s the cultivated area per household is generally low. In Kambata, Menz-Gishe and Haikotch-Butajira *Awrajas* (provinces) for example, the average cultivated land was reported to be between 0.5 and 1.2 hectares. On top of its small size, the average cultivated land was also highly parcelled. In Jibat-Mecha, Selale, Tegulet-Bulga and Yerer-Kereyu *Awrajas* a household often cultivated between three and four scattered plots of land. Coupled with backward farming techniques and occasional drought that mainly characterizes the northern part of the region, shortage of grain manifests itself in most of Menz-Gishe, Yifat-Timuga and Yerer-Kereyu *Awrajas*. Although the grain plough complex is the dominant farming system in the region accounting for more than 50 percent of the area under cultivation, the *Enset* complex in the south mainly found in eastern Haikotch-Butajira and central Kembata-Hadiya, claims about 8 percent of the farming system. Manufacturing activities in the region (excluding metropolitan Addis Abeba) is very small (AAMPPO, 1985).

2.2 Population Characteristics

2.2.1 Age-Sex Distribution

For reasons outlined earlier, the sample on which this study is based consists of only a segment of the total population of the study area, women between ages 15 and 49 years. This section, almost inevitably, therefore, draws heavily on the Analytical Report for the Region published by the Office of Population and Housing Census Commission (1989). The Report is based on the same census data. Including the less than one percent of the population which was not covered by the census, the estimated population of the region as of May 1984 was put at 8,102,325 of which 4,027,114 (49.7%) were males and 4,075,211 (50.3%) were females. Consequently the sex ratio for the whole region was 98.8. The corresponding figures for the rural and urban areas were reported as 100.1 and 87.5 respectively. Blacker (1986) also noted a low sex ratio of 84 in the urban areas for the central region, of which Shewa is the dominant component. This somewhat perplexing phenomenon is in contrast to that observed in most developing countries where the fair sex is usually in minority in the urban areas due mainly to higher male migration, presumably in search of jobs.

Classification of the population by broad age groups as set out in Table 2.1 reveals that the population was quite young with children under 15 years of age constituting half of the population. Consequently, young dependency burden defined

as a ratio of number of children under age 15 to persons between 15 and 60 years of age, was 112. It means that, on the average, every 100 working people should support about 112 children on top of sustaining themselves and old dependents.

Table 2.1

Distribution of the Population
by Broad Age-Group and Residence
Shewa, 1984

Broad Age-Group	Place of Residence					
	Rural		Urban		Total	
	No.	%	No.	%	No.	%
0-14	3573608	49.3	357204	46.1	3930812	49.0
15-59	3138686	43.3	365728	47.2	3504414	43.7
60+	536403	7.4	51915	6.7	588318	7.3
Total	7248697	100	774847	100	8023544	100

Source: OPHCC, *Analytical Report on Shewa,* 1989, Table 1.7

The urban population accounted for a mere 10.7 percent of the total population of the region when urban was defined as a locality with 2000 or more inhabitants, an administrative center up to the lowest hierarchy or recognized as urban by Ministry of Urban Development and Housing (OPHCC, 1989). Because of the location of Addis Abeba in the center of the region, however, the impact of urbanization is far greater than that implied by the figures.

2.2.2 Religion and Ethnicity

Since its introduction in 330 A.D., via the Axumite kingdom, Christianity has been the dominant and until recently the state religion. With the coming of Islam much later, the two religions almost exhaust the population of the region between themselves. According to the 1984 census, 75.3 percent of the population of the region profess Christianity with 67 percent of them being Orthodox Christians, 7 percent Protestants and 1.3 percent Catholics. Moslems form 23.4 percent (see Table 2.2.).

Three major ethnic groups, Oromo, Amara and Gurage account for over 82 percent of the population in the study area. The first two are the dominant groups, elsewhere in the country too. As can be observed from Table 2.3, the Oromos form the preponderant majority of 41.2 percent followed by Amaras (22.9%) and Gurages (18.1%). In the Urban areas, however, the Amaras are in majority accounting for 43 percent with the Oromos relegated to second place (28%) and the Gurages sticking to their third (13.8%) Kembata and Hadiya together accounted for about 13 percent with the multitudes of other groups forming the insignificant balance.

2.2.3 Nuptiality

Marriage is early and universal in the study region. The singulate mean age at marriage was reported as 18 years for females and 23.4 years for males. The corresponding figures in the urban areas of 20.4 and 26.6 years for females and males respectively was higher than for the rural areas. Blacker (1986) believes that marriage in the study area is relatively early when compared even with other African countries. Thus in the age group 25-29, only less than 10 percent of the females

Table 2.4

Percentage Distribution of Population 10 Years and Above by Urban-Rural Residence, Sex and Marital status Shewa, 1984

	Reported Marital Status				
Residence/Sex	Single	Married	Widowed	Divorced/ Separated	Total
Shewa					
Male	39.2	56.9	1.3	2.6	100.0
Female	24.8	59.4	9.0	6.8	100.0
Both Sexes	31.9	58.1	5.2	4.8	100.0
Rural					
Male	38.0	58.3	1.3	2.4	100.0
Female	23.5	61.9	9.1	5.5	100.0
Both Sexes	30.8	60.1	5.2	3.9	100.0
Urban					
Male	50.3	43.6	1.2	4.9	100.0
Female	35.1	39.3	8.1	17.5	100.0
Both Sexes	42.0	41.2	5.0	11.8	100.0

Source: OPHCC, *Analytical Report on Shewa Region,* 1989, Table 1.18.

in the rural areas were not married in 1984. He observed that the population did not appear to have partaken in the general rise of age at marriage.

The percentage composition of marital status is displayed in Table 2.4. About 60 percent of females and 57 percent of males were currently married at the time of the census. Percentage married for both sexes was higher in rural than in urban areas. In the urban areas unlike in the rural, there were higher percentage of currently married males than females.

2.2.4 Education and Literacy

A person is literate if he can, with understanding, both read and write a short, simple statement in his/her every day life (UN, 1980). Accordingly, the census result indicated that 23.2 percent of the population 10 years and over was literate as shown in Table 2.5. This, however, masks a great deal of variation in the literacy status between the sexes on the one hand and urban and rural areas on the other. In the lower panel of the Table about 66 percent of urban population against only 18 percent in the rural (more than 3.5 times) was literate. Although the literacy rate for males was generally much higher than that for females, the gap was smaller in urban than in rural areas .

Table 2.5

Percentage Distribution of Population 10 Years and Above by Educational Levels, Sex and Urban-Rural Residence
Shewa, 1984

Educational Level	Sex	Place of Residence: Rural	Place of Residence: Urban	Total Region Shewa
Read and write	Male	7.7	9.0	7.8
but with no	Female	3.1	6.8	3.5
formal education	Both Sexes	5.3	7.8	5.6
Elementary	Male	16.7	44.3	19.4
(1-6)	Female	6.5	37.3	9.9
	Both Sexes	11.6	40.5	14.5
Junior + Senior	Male	2.1	21.5	4.0
Secondary	Female	0.5	11.4	1.7
(7-12)	Both Sexes	1.3	16.0	2.8
Above 12	Male	0.2	1.9	0.4
	Female	0.1	0.6	0.1
	Both Sexes	0.1	1.2	0.2
Literate	Male	26.8	76.9	31.7
(total)	Female	11.2	56.3	15.3
	Both Sexes	18.3	65.7	23.2
Illiterate	Male	73.2	23.1	68.3
	Female	89.8	43.7	84.7
	Both Sexes	81.7	34.3	76.8

Source: Adopted from OPHCC, *Analytical Report on Shewa,* 1989, Tables 2.9, 2.9(a), 2.9(b).

In the upper panel of Table 2.5 over 40% of the urban and 11% of the rural population 10 years and above had some form of elementary schooling. While 16% had attended secondary education in the urban areas, the corresponding figure for the rural areas was insignificant (only 1.3%). Above secondary education was negligible in both. The fact that only less than 7 percent of the women in the rural areas had any form of schooling at all, is a grim face of underdevelopment that remains to be tackled if any social and economic progress is to be contemplated.

2.2.5 Households Amenities

For well known reasons, questions on income of households were not asked in the census. In the absence of an indicator of the living standard of the population, housing conditions or household amenities may be taken as a proxy of living conditions. Unfortunately, information regarding housing facilities and amenities were not collected for the rural areas where 90% of the population reside. Table 2.6 demonstrates distribution of housing units by type of lighting and ownership of consumer durables in the urban areas. It is clear from the Table that 61 percent of the population had electric lighting while 31 percent used kerosine lamp. As for consumer durables, 43 percent possessed radios.

Table 2.6

Distribution of Housing by Type of Lighting and Ownership of Consumer Durables
Shewa(Urban), 1984

Type of Lighting Facilities	Percent	Ownership of Consumer Durables	Percent
Electric meter	60.9	Radio	42.8
Kerosine lamp	31.0	Television set	6.3
Lantern and others	6.7	Telephone	9.7
Not stated	1.4		
Total	100.0		

Source: OPHCC, *Analytical Report on Shewa Region,* 1989, Tables 5.13 and Table 5.14.

Percentage ownerships of television and telephone sets were 6.3 and 9.7 respectively. The last two are virtually non-existent in the rural areas. Although Shewa was expected to be relatively better than most other administrative regions, the above figures do not suggest much source of comfort.

CHAPTER THREE

LEVELS AND TRENDS OF INFANT AND EARLY CHILDHOOD MORTALITY

3.1 Data Appraisal

Before directly passing into the estimation of the levels and trends of childhood mortality, a few words about the quality of the data in hand is in order. Even then, a detailed effort to evaluate or smooth the data is not attempted here. This is because, the type of data at our disposal (only women in the age bracket 15 to 49 years) is not exactly compatible with the data requirements of the various conventional accuracy indices (eg Whipple's, Myer's, UN Joint Score etc.). Also, evaluation regarding the census data for the region has already been undertaken by the Office of Population and Housing Census Commission (1989). Moreover, since the main thrust of this study is on the uni- and multivariate differentials of child mortality, it is less affected by across the board omission of children or misreporting of ages among women under study than by systematic variation in magnitude of error among different population groups.

Nevertheless, comparison of the age distribution of the sample with the population of the region (from the published report), highlighting of evaluation of data already made by the Commission, and performing some consistency checks regarding average parities, proportions of children dead and sex ratios are carried out

to appraise the data. First, a Chi-square test is used to determine if the age distribution of the sampled population is consistent with that of the Census population of the region from which it is selected. It is evident from Table 3. 1a

Table 3.1a

A Chi-Square Test to Determine if the Age Distribution of the Sample Differs from that of the Census Population, Shewa Region, 1984.

	Age group						
	15-19	20-24	25-29	30-34	35-39	40-44	45-49
Sample(O)	14940	12118	13534	12812	11465	9399	6260
Census(E)	15084	12204	13537	12766	11397	9329	6212
$(O-E)^2/E$	1.3747	.60603	.00066	.1657	.4057	.5252	.3709
χ^2 value (Calculated)	3.449						

Note: For degree of freedom = 6, $\chi^2_{.05} = 12.59$; $\chi^2_{.01} = 16.81$

Sources: Compiled from

(1) A sample of the 1984 Population and Housing Census of Ethiopia (tape)

(2) OPHCC, Analytical Report on Shewa Region Addis Ababa, 1989

that the difference between the two age distributions is insignificant both at .05 and .01 levels. The same test for both urban and especially rural populations show that the differences are very small (chi-square values of 3.644 and 0.9438 respectively).

The consistency in age distribution we have just witnessed has two cutting edges. The various types of errors that are hard to avoid in a gigantic operation like a census are likely to be reflected in our sample too, and more likely in similar magnitudes. It is, therefore, essential that the limitations of the data be detected and their approximate magnitudes indicated. Different indices were used to evaluate the age-sex data in Shewa administrative region (OPHCC, 1989). In this kind of undertaking, usually caution is advised before resorting to the use of an array of techniques. In the absence of demographic evidence such as age-sex differentiated epidemics and migration in the region, the deployment of the various accuracy indices was inevitable, it seems.

The single year age distribution was highly erratic and showed that digits 0 and 5 were the most preferred while 1 and 9 the least preferred. The deficiencies of the age sex data are reflected in the values of 244, 25.9 and 75.6 for Whipple's, Myer's and Joint Score indices respectively suggesting that the data are of dubious quality to say the least. So long as there is no evidence that the age error in the foregoing had any systematic relation with parity, fertility or proportion children surviving, however, inaccurate reporting of age would not have a major effect on the estimates of q(x) (Brass & Coale, 1968).

Table 3.1

Number of Women, Children Ever Born, Sex Ratio and Proportion of Children Dead by Age of Women, Shewa, 1984.

Age group of women	Number of women adjusted for non response	Children Ever Born				Sex ratio of CEB	Children Dead			
		Males		Females			Males		Females	
		Number	Parity	Number	parity		Number	PD_i	Number	PD_i
15-19	14363	2450	.1706	2349	.1635	1.0430	315	.1286	320	.1362
20-24	11650	9665	.8296	8889	.7630	1.0873	1499	.1551	1292	.1453
25-29	13011	18577	1.4278	17076	1.3124	1.0880	2939	.1582	2599	.1522
30-34	12317	2407	1.9653	21809	1.7706	1.1100	4341	.1793	3480	.1596
35-39	11022	25789	2.3400	23716	2.1517	1.0874	4898	.1899	3986	.1681
40-44	9036	2263	2.5045	20182	2.2335	1.1213	4845	.2141	3798	.1882
45-49	6018	15318	2.5454	13382	2.2237	1.1447	3675	.2399	2834	.2118
Total	77417	118637	1.5324	107403	1.3873	1.1046	22512	.1897	18309	.1705

Source: Compiled from a sample of the 1984 Population and Housing Census of Ethiopia for Shewa region (tape)

The consistency of the data in our sample may also be checked from the number of children everborn and children dead which is provided by sex in table 3.1. In all human populations the sex ratio at birth varies within a narrow range between

102 and 107 (UN, 1983) apparently for some biological reasons. An examination of the sex ratios in the table shows that the overall sex ratio of CEB was 110. While modest deviations in sex ratios from the expected range are observed up to the age of 39, they become much higher for the last two age groups. Such a pattern suggests a probable higher omission of female than male children ever born although misreporting of the children's sex could also reveal similar pattern (UN, 1990a).

Further examination of the average parities in the same table indicates an increase with age up to the last age group. The increase in the last two age groups seems too small. In fact, a slight decline in average parities in the last age group for female children is noticed. Such a behaviour together with the high sex ratios in the last two age groups, mentioned earlier, suggest the existence of omission errors especially female children which are likely to contain disproportionately higher number of dead children. The expected increase of proportion dead with increase in age of women is evident for both male and female children. Proportion dead should increase more rapidly after the age of 35 years. Comparison with corresponding figures from the 1990 Family and Fertility Survey for the country reveal under reporting of dead children by as much as 20 percent. (CSA, 1991)

3.2 Levels of Infant and Child Mortality

In the absence of reliable registration data and the spuriousness of current

death data from censuses and surveys, the Brass method (Brass & Coale, 1968) permits us to estimate the levels of infant and child mortality from retrospective data on the number of children ever born and number of those surviving among those born by each woman, often in the reproductive age bracket. From such data, the proportion of dead children to each age group of mother is converted to a life table mortality measure, q(x) which is amenable to a wide possibility of mortality analysis. The simple equation that allows such a transformation is

$$q(x) = k(i)D(i), \quad \ldots\ldots\ldots\ldots \quad (3.1)$$

where q(x) is the probability of dying from birth to exact age x, D(i) is the proportion of dead children to age group i of the mother and k(i) is an adjustment factor to take care of the variation in the age pattern of fertility. The variation in the length of exposure to the risk of dying (age) of children in a given mortality condition depends on the onset of fertility. In the original Brass method, for instance, at mean age of fertility schedule of about 28 years D(1), D(2), ... are approximately equal to q(1), q(2), ... (Brass & Coale, 1968). In an early fertility society the children would be older and the proportion dead, D(i)s are greater than the corresponding q(x) values and hence must be multiplied by a number less than unity so that the D(i)s depict the avergae life table q(x) values. In late fertility society, on the other hand, the proportion dead, D(i)s would be less than the corresponding q(x) values and hence must be inflated by a number greater than unity so as to match to the average life table q(x) values. The early or late start of fertility is identified by the parity ratios and also by mean and median ages of fertilty in the original Brass method. Therefore,

since the average age of the dead children in this method depends on the age of their mothers, other factors that distort the distribution of the duration of mortality exposure like variation in the commencement of fertility must be controlled. Hence the need for an adjustment multiplier based on variation in the age pattern of fertility.

The general Brass method works under certain assumptions

(1) The age specific fertility schedule has been approximately constant in the recent past (at least for the youngest women) and the approximate form of the schedule is known.

(2) Infant and child mortality rates have been approximately constant in recent years.

(3) There is no powerful association between age of mother and infant mortality or between death rates of mothers and their children.

(4) Omission rates of dead and surviving children are about the same in the reported number ever born.

(5) The age pattern of mortality among infants and children conform approximately to model life tables.

Over the years some refinements of the basic Brass method were made. Sullivian(1972) and later Trussell (1975), with an identical approach, examined the relationship between a ratio of q(x) to D(i) (q(x)/D(i)) on the one hand and fertility

parameters (parity ratios) on the other in the least square regression analysis. Each came up with his own version of a set of multipliers. The major innovations made by both was the attempt to increase the flexibility of the method by introducing the four mortality patterns of the Coale-Demeny (1966) model life tables as opposed to a fixed mortality pattern of the original Brass method. In addition, Sullivain utilized empirical fertility data while Trussell used a simulated fertility data as opposed to Brass' fixed fertility model (fertility polynomial). Sullivian multipliers are computed for three young age groups of mothers while Trussell's are computed for seven age groups.

Although the differences among the three procedures, in terms of the derived estimates, are slight, the Trussell variant is the most widely used since it uses a wide data base, more specifically 1568 fertility schedules in contrast to Sullivain's only 65, of course, both in combination with the four mortality patterns of the Coale-Demeny (1966) model life tables. For the same reason, the Trussell variant with his most recent multipliers (UN, 1983), is used in the estimation of both child mortality levels and trends in Shewa region. Nevertheless, the Sullivian estimates of early childhood mortality levels are also provided for comparison purposes. The Sullivian equation of the North model family is

$$\begin{aligned} q(2) &= D(2)(1.30 - 0.63p(2)/p(3)) \\ q(3) &= D(3)(1.17 - 0.50p(2)/p(3)) \\ q(5) &= D(4)(1.15 - 0.42p(2)/p(3)) \end{aligned} \qquad (3.2)$$

while the Trussell estimation equations are

$$k(i) = a(i) + b(i)p(1)/p(2) + c(i)p(2)/p(3) \qquad (3.3)$$

$$\text{and} \quad q(x) = k(i)D(i) \qquad (3.4)$$

where k(i) is an adjustment factor

a(i), b(i) and c(i) are the more recent Trussell multipliers

q(x), the probability of dying from birth to exact age x

D(i) is proportion of children dead for the i^{th} age group of women.

p(1), p(2) and p(3) are average parities of women in age groups 15-19, 20-24, and 25-29 respectively.

The adjustment multipliers, observed above, are functions of the parity ratios in both the Sullivan and Trussell equations. Parity is a ratio of the number of children everborn to the total number of women in each age group. But about 20 percent of the women in our sample did not state the number of children they have given birth to and their indiscriminate inclusion or exclusion was, therefore, believed to seriously affect the parity ratios. To circumvent this, the El-Badry adjustment technique is often recommended prior to computing the parity ratios (UN, 1983:230).

By estimating the 'true non-response' from the reported not stated categories that are assumed to include a big proportion of childless women, the 'true not stated' cases are reduced from around 20 to about 4 percent in the region and from 20 to about 4.5 percent in the rural areas. Although the not stated category is substantial

in the urban areas as well, the 'true' non-response is found to be negligible and consequently no adjustment is attempted. In spite of our effort, the parity ratios remained the same both when all women are included in or when the 'true' non-response are excluded from the denominator. So contrary to our expectations, the El-Badry method of adjustment did not, in any way, change our result.

For comparison purposes, the probabilities of dying by age x, q(x) derived by the Brass, Sullivan and Trussell procedures are provided in table 3.2 below. The Brass multipliers are based on fixed mortality pattern, the Brass General Standard which is equivalent to the West model life table in the Coale-Demeny model life table system. Therefore, the Sullivan and Trussell estimates in table 3.2 are also based on the West model. The estimates from the three methods, especially the q(3) values, show small variation. In the Sullivan and Trussell methods q(2) values are greater than q(3) values.

In terms of the North model which is expected to depict the mortality pattern in Shewa region (rationale is explained in chapter 1), probabilities of dying between birth and exact ages of 2, 3 and 5 years using both the Sullivian and Trussell versions are presented in table 3.3. As may be observed in the table the q(2) value, except for the urban population, exceeds those of q(3) which is theoretically impossible. The higher value of q(2) compared with q(3) and occasionally even with q(5) was also

Table 3.2

Estimates of the Probabilities of Dying from Birth to Age x, q(x) by Brass, Sullivan and Trussell Methods (West model), Shewa, 1984.

Method of Estimation	Probabilities of Dying, q(x)		
	q(2)	q(3)	q(5)
Brass	.144	.149	.165
Sullivan	.148	.146	.160
Trussell	.149	.148	.165

Source: As for table 3.1

observed in studies based on the 1981 rural demographic survey (Kassahun 1986, Genet 1987) and data from some African populations (Blacker, 1979). Unfortunately, this anomaly is one of the inbuilt weaknesses of the general Brass method.

The average infant ($_1q_0$), child ($_4q_1$) and under five mortality ($_5q_0$) rates in the region implied by q(2), q(3) and q(5) estimates are shown in table 3.4.

Table 3.3

Probabilities of Dying by Exact Age x, q(x) Estimated by Sullivian and Trussell Versions, (North model) by Region of Residence and Sex, Shewa, 1984.

Residence / Sex	Probabilities of dying by age x, q(x)					
	Sullivian Version			Trussell Version		
	q(2)	q(3)	q(5)	q(2)	q(3)	q(5)
Shewa Region	.141	.137	.154	.141	.139	.160
Rural	.143	.138	.155	.143	.140	.162
Urban	.113	.125	.139	.116	.128	.143
Male	.145	.139	.163	.146	.142	.168
Female	.136	.134	.145	.136	.137	.150

Source: As for table 3.1

Table 3.4

Average Infant, Child and Under Five Mortality per 1000 Live Births Implied by q(2), q(3) and q(5) Values (Trussell version, North model)

Shewa, 1984.

Residence/ Sex	(Rates per 1000 births)		
	Infant mortality rate ($_1q_0$)	Child mortality rate ($_4q_1$)	Under five mortality rate ($_5q_0$)
Shewa Region	101	73	167
Rural	102	74	168
Urban	90	62	146
Male	105	76	173
Female	98	70	161

Source: As for table 3.1

Infant mortality rate (IMR) for the region is thus 101 infant deaths per 1000 live births. The corresponding child moratality rate is 73 deaths out of 1000 children between exact ages of one and five years and 167 deaths per 1000 birth cohort. This means that 17 percent or one out of every six children in the region does not survive to age five. It is important to note at this juncture that the infant and child mortality estimates made by Brass method should be regarded as the lower limits of mortality levels in the region. Indeed, infant, child and under five mortalities derived from a survey in 1986 on birth histories for the region were reported as 126, 62 and 181 deaths per 1000 births respectively (Blacker, 1986). Since Blacker's estimates are not likely to overestimate child mortality in the region, it appears that our levels must have been underestimated. In terms of the more reliable under five mortality measure, mortality is higher in rural than in urban areas and for males than for females . Our results regarding the values of q(2), q(3) and q(5) are in close agreement with the published results for the region (OPHCC, 1989). Because of the different adjustment techniques used, however, regarding women of parity not stated category, a discrepancy in average parities is observed. The prorating technique used by the Commission is likely to raise average parity by distributing many childless women across non-zero parity groups.

3.3 Estimated Trends of Child Mortality in Shewa

The consensus of opinion regarding the rapid decline of mortality in the

developing countries in the last few decades is in contrast to lack of general agreement concerning the reasons that caused such a relatively fast pace of decline in the first place. Earlier on, the decline was linked to economic development and growth of income. Later, by and large, it was attributed to rapid advances made in medical technology related to prevention and control of disease in the developed countries which were then imported to the developing countries at a relatively small cost and often in the form of aid (UN, 1973). Subsequent studies stressed the importance of 'social' factors like education, occupation and urban-rural residence of mother in the decline of child mortality (Caldwell, 1979). Recently even behavioural factors like 'basic ability and personal characteristic of the mother', in addition to other social and economic factors, are believed to play important role in explaining the 'clustering of deaths' among children (Das Gupta, 1990). It is highly likely that the various factors outlined above and probably others are working jointly, with the relative importance of each changing at different stages of social and economic development.

Determination of the trends of mortality is straight forward provided reliable data on number of children born and dead at various times in the past exist. Paucity of data in the study area, however, does not permit such an approach. The two data sets (1970 and 1981) from surveys of rural Shewa are different with regard to level of accuracy, coverage etc. in comparison with the 1984 national census and even between the two data sets themselves. An examination of the three data sets in

Table 3.6

Estimates of the Probabilities of Dying by Age x,

q(x) Using the Trussell Procedure in North Model,

Rural Shewa, 1970, 1981, 1984.

Age of child x	Probabilities of dying by age x, q(x)		
	1970	1981	1984
1	.150	.161	.131
2	.148	.177	.142
3	.158	.161	.140
5	.183	.208	.161
10	.230	.231	.181
15	.241	.260	.201
20	.278	.264	.222

Sources: Computed from:

(1) For 1970, CSO, The Demography of Ethiopia, vol II, part II, Addis Ababa, 1974

(2) For 1981, CSO, Report on the Results of the 1981 Rural Demographic Survey, Addis Ababa, 1985

(3) For 1984, as in table 3.1

Table 3.6 for any clue on trends of child mortality in rural Shewa does not reveal any. No coherent mortality pattern is discerned. If the figures in table 3.6 are to be taken

at face value, they imply a rise in child mortality in the decade between early 1970s and early 1980s followed by a substantial decline in just three years that follow. This is, in all probabilty, an indication of lack of consistency in the three data sets rather than the presence of any trend. Mortality is likely to decline or remain constant rather than to increase in the decade between the 1970s and 1980s. It appears that level of child mortality is underestimated in the 1984 and especially so in the 1970 data sets relative to that of 1981.

In this section an approximate trend of child mortality in Shewa region is obtained from the 1984 census data by making use of the procedure developed within the general Brass method. The assumption of constant mortality in the original Brass method was later relaxed through the works of Feeney (1980), Coale and Trussell (1977) and others allowing for a steady decline in child mortality. The above authors showed that if the rate of change of mortality over time was approximately constant, a set of years to which each q(x) value refers can be estimated. Since Feeney's procedure was developed from data generated by using one parameter logit life table system derived from the general standard and the Brass fertility polynomial as well as the sensitivity, a model choice would have on infant mortality (used as index of mortality by Feeney), this method is not used here.

On the other hand, the Coale and Trussell procedure is based on the Coale Demeny (1966) model life tables and the equations for the location of time are

consistent with the equation for estimating the multipliers. This later procedure is , therefore, used in the determination of child mortality trends. According to this method, assuming a roughly constant rate of change in child mortality, a period of time to which each of the Brass type child mortality levels refer can be estimated. This time location refers to the number of years before the census when the estimated levels prevailed. The equation utilized in computing the number of years prior to the survey, t(x) is

$$t(x) = a(i) + b(i)(p(1)/p(2)) + c(i)(p(2)/p(3)), \ldots\ldots\ldots (3.5)$$

where a(i), b(i) and c(i) are coefficients determined by linear regression

p(1), p(2) and p(3) are average parities of women in age group 15-19, 20-24 and 25-29 respectively.

Other than the time location, each of the q(x) values corresponding to each age group of mother must be expressed in one common index for the establishment of child mortality trends. Under five mortality, q(5) is accordingly selected as the common index over that of q(1) as the later is very sensitive to choice of mortality pattern underlying the different models. Moreover, in situations where the accuracy of data is questionable, as in our case, estimates of q(5) may well be more robust than estimates of q(1) (UN, 1990b:124). Therefore, the use of q(5) as a common index in place of the various child mortality estimates in conjunction with the reference dates to which each value of the common index refers determine the trends of child mortality in the recent past in Shewa region.

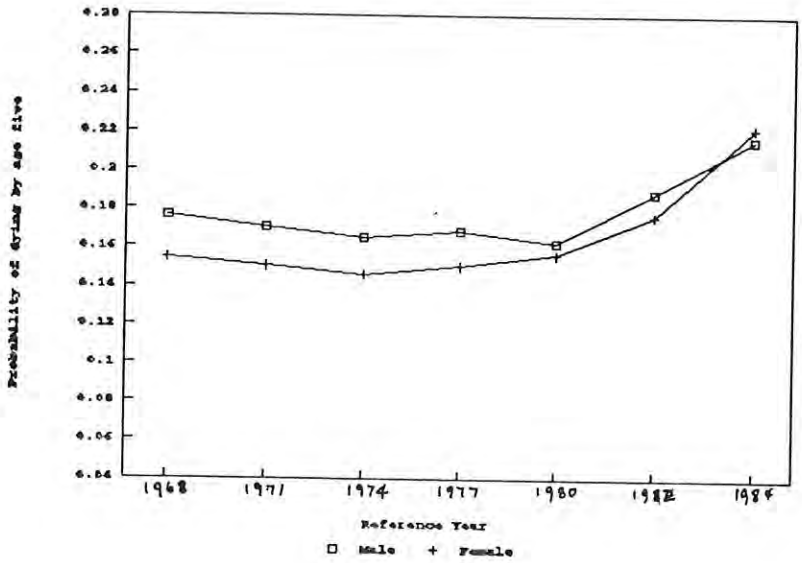
Table 3.7

Under Five Mortality, q(5) Consistent with Childhood Mortality Estimates, q(x) and Corresponding Reference Dates by Sex, Shewa, 1984.

Age x	Reference date	Under five mortality		
		Males	Females	Both Sexes
		$q^c_M(5)$	$q^c_F(5)$	$q^c(5)$
1	1983.3	.216	.222	.220
2	1981.7	.188	.176	.182
3	1979.5	.162	.156	.159
5	1976.8	.168	.150	.159
10	1974.0	.165	.146	.156
15	1971.1	.170	.150	.161
20	1968.2	.176	.154	.165

Source: as in table 3.1

Both from table 3.7 and figure 1 the level of mortality, for the first age group of women (15-19) is almost always high. It was also observed (UN, 1990a) that, the



Source: Table 3.7

Figure 1

Under five mortality, q(5) for males and females by year estimated using the North model and the Trussell variant

Brass method is not likely to indicate any change in trend until at least two years after the change took place. The mortality experience of women in this age group would also affect those in ages 20-24 as they move into that age group. So we have disregarded these two age groups. It is usually posited that child mortality level based

on the experience of old women too is unreliable with a general tendency of being under estimated. It is to be remembered that the very high sex ratio for the last two age groups in our data coupled with the observed slight increase in parity for males and even a decline for females strongly point to differential omission of female children. The disproportionate omission of dead children is highly probable and therefore the last age group of women is also disregarded. Thus the true child mortality pattern may not be known with any certainty. From the remainder of q(5) values (see also fig. 1), however, it appears that child mortality in the 1970s remained constant fluctuating around 160 deaths per 1000 live births for both sexes combined. For male and female children, the fluctuation was around 167 and 150 per 1000 live births respectively. The casual appearance of a general tendency of an increase in child mortality suggested by figure 1 may well be spurious. We can, nevertheless, say that there was no improvement in child mortality in the recent past.

CHAPTER FOUR

INFANT AND CHILD MORTALITY DIFFERENTIALS IN SHEWA REGION

4.1 Introduction

The enormous gap in the level of child mortality that prevails between the developed and developing countries is now well known and sufficiently documented. What is probably less apparent is the considerable difference that exists in chances of survival among children of different population groups each of which share some common geographic, social and economic characteristics in developing countries. The contrast in child mortality in Ibadan city (Nigeria) which was well described by Caldwell (1979) is a case in point. He identified families, on the one hand with mortality regime more akin to recent industrialized countries with an implied expectation of life in the high sixties and on the other, a regime with an implied expectation of life around 37 years, akin to experience of the industrialized countries a century and a half ago.

To be sure, variation in child mortality does exist in all populations, but it is more pronounced in low than high mortality populations (UN, 1973). With the general improvement in survival status, the mortality differences among different groups is believed to narrow down. Consequently, the general improvement in survival status is very much contingent on the obliteration of the observed mortality

gaps. That is why a thorough understanding of child mortality differential is found to be of considerable importnace.

It is posited that changes in the socio economic factors would trigger a corresponding change in child mortality. The impact of these factors on child mortality is only indirect, through other 'bio-medical' factors that influence child mortality directly like maternal fertility factors, environmental contaminations, nutritional availability, injury and personal disease control factors (Mosley & Chen, 1984).

One of the problems encountered in the study of mortality differential is related to the timing of characteristics that exist during data collection (UN, 1985). In this type of study, it is assumed that the variables of interest existed long before the incidence of child death occurred. If a woman, for instance, acquires some form of education after she stopped child bearing, this is likely to distort the true impact of education on child mortality. Still another drawback is related to measurement. Things like status of women are hard to measure and the distinction between work status of mother in relation to child mortality, as in our case, is fluid. We argue, therefore, that if it were not for the foregoing and other drawbacks the influences most of the variables exert would be greater than the results obtained.

A large proportion of women (about 20 percent) did not state their parity.

This created a dilemma of whether to include or exclude these women when computing the probabilities of dying originally intended as a basis of comparison. Instead, the proportion of children dead, which does not involve the women, is used as an index of comparison in child mortality differential. This is not expected to alter our final conclusions. Furthermore, in an effort to take care of the effect of age distribution of the children everborn on the proportion of children dead, the method of direct standardization, with the distribution of children of Shewa region as a standard, was applied on the various categories of estimated proportion dead. In general, narrowing down of the differences in child mortality, among the various categories, is observed. Nevertheless, the change in the original relationship among the categories, in most cases, are inconsequential and hence the not standardized proportions dead are utilized through out this chapter.

4.2 Maternal Education and Child Mortality

A dichotomous educational classification of mothers with some schooling and those with no schooling are used in the study. The former includes all women who have had some form of formal education of completing grade one or above. The latter includes all illiterate women and those who can read and write but with no formal schooling. It would have been more illuminating if further detailed classification had been adopted. The limited educational opportunity in the region, reported earlier, would not allow enough women to be included in each educational

category, especially when controlling for age and other related factors. The provision of data by age-group of mothers effectively checks any bias in educational opportunity in favour of younger mothers.

In harmony with the accumulated evidence, table 4.1 corroborates the view that there is indeed a strong inverse relationship between maternal education and child mortality. This comes out clearly in the univariate result in panel one of the table. Child mortality for mothers with no schooling is higher than for their schooled peers by 46 percent (.1843/.1265). This relationship holds invariably across all age groups of women. Women who can read and write through traditional education or literacy campaign have child mortality experience more akin to the illiterate than to the literate women. It may be the case that traditional education or literacy campain alone has little impact in the reduction of child mortality.

Even when urban-rural residence is controlled in the middle and last panels of table 4.1, the intensity of the relationship is hardly diminished. In both rural and urban areas the survival advantage for schooled mothers is maintained by more than 42 percent. Higher mortality gap between the schooling and no schooling women is observed in urban (60%) than in the rural (43%). This might be an indication that skills and knowledge of child care practices including nutrition as well as use of health facilities and other infrastructure like safer water supply can be put to greater advantage in the urban areas where these facilities are evidently concentrated.

Perhaps the most revealing aspect of table 4.1 is that women with no schooling do not appear to benefit from the general lower mortality in urban than in rural areas. On the contrary, they exhibit higher child mortality than their fellow sisters in the rural areas. Urban life for the uneducated mother, does not seem to be any less hostile. In fact, as the result implies, in the absence of protective armory like education, the congestion and lack of hygiene of the urban environment might pose even more threat to child survival. Other routes through which education operates, like increasing the status of women or possibilities of educated women attracting more educated husbands, could not be tested from our data.

Table 4.1

Proportion of Children Dead by Age and Education of Mother, Shewa, 1984.

Residence / Educational Status	Age group of mother					
	Total 15-49	20-24	25-29	30-34	35-39	40-44
Region						
Schooling	.1265 (14512)	.1181 (2303)	.1137 (3191)	.1145 (3415)	.1374 (2649)	.1624 (1398)
No schooling	.1843 (211401)	.1550 (16225)	.1594 (32450)	.1744 (42560)	.1818 (46853)	.2032 (41396)
Read and write only	.1631 (8553)	.1790 (849)	.1395 (1591)	.1277 (1825)	.1797 (2015)	.1891 (1216)
Urban						
Schooling	.1243 (7120)	.1220 (926)	.1110 (1468)	.1032 (1938)	.1456 (1446)	.1683 (719)
No schooling	.1988 (11637)	.1144 (612)	.1686 (1471)	.1926 (2233)	.1864 (31551)	.2218 (2209)
Rural						
Schooling	.1286 (7392)	.1155 (1377)	.1161 (1723)	.1293 (1477)	.1275 (1200)	.1561 (679)
No Schooling	.1835 (199764)	.1566 (15613)	.1590 (30979)	.1734 (40327)	.1815 (43698)	.2022 (39187)

Note: Figures in parenthesis indicate the number of children ever born in the respective age groups of mother.

Source: Compiled from a Sample of the 1984 Population and Housing Census of Ethiopia

4.3 Urban-Rural residence and Child Mortality

The difference in child mortality in urban and rural areas is explored in table 4.2. Child mortality in urban areas is slightly lower, by about 6.5 percent (.1815/.1706) in comparison to the rural areas. Although the difference is small,

Table 4.2

Proportion of Children Dead by Urban-Rural Residence and Age of Mother, Shewa, 1984.

Educational Status/ Residence of mother	Age group of Mother					
	Total 15-49	20-24	25-29	30-34	35-39	40-44
Total						
Urban	.1706 (18811)	.1188 (1548)	.1402 (2946)	.1517 (4193)	.1734 (4607)	.2087 (2932)
Rural	.1815 (207229)	.1533 (17006)	.1567 (32707)	.1718 (41823)	.1801 (44898)	.2014 (39876)
Schooling						
Urban	.1243 (7120)	.1220 (926)	.1110 (1468)	.1032 (1938)	.1456 (1449)	.1683 (719)
Rural	.1286 (7392)	.1155 (1377)	.1161 (1723)	.1293 (1477)	.1275 (1200)	.1561 (679)
No Schooling						
Urban	.1988 (11637)	.1144 (612)	.1686 (1471)	.1926 (2233)	.1864 (3155)	.2218 (2209)
Rural	.1835 (199764)	.1566 (15613)	.1590 (30979)	.1734 (40327)	.1815 (43698)	.2022 (39187)

Note: Figures in parenthesis indicate the number of children ever born in the respective age groups.

Source: As for table 4.1

it could be attributed to many factors like superior public health services, safe water supply system or better educational opportunities etc..

The urban-rural difference is re-examined controlling for education in the same table. Remarkably, when education is controlled the urban-rural variation in child mortality became negligible. For women with no schooling the relationship is reversed, where a decided mortality advantage in favour of rural women is observed. For these women any advantage they could expect to gain in terms of medical facilities, water supply etc. in urban areas is more than off set by the poor hygienic condition which is one main feature of urban areas in this part of the world.

The difference in mortality between rural and urban areas is very small. So is the difference between the rural and urban areas themselves. Most of these so called urban areas are very little different from their surrounding rural areas in the region. Because of Addis Ababa as a major urban center, they can be regarded as mere satellites with out properly developed urban systems.

4.4 Awraja of Residence and Child Mortality

As a central region, Shewa is not only the confluence of different cultures, but also the meeting place of different topographic and climatic conditions. The three southern *Awrajas*, of Chebo-Gurage, Kembata-Hadiya and Haikoch-Butajira, which

are also the most densely populated in the region along with a fourth, Yifat-Timuga in the north-east have the highest child mortality. On the other hand, the central *Awrajas* of Menagesha, Selale and Tegulet-Bulga show the lowest level. The three southern *Awrajas* and a fourth Yifat-Timuga in the N.E. as a group exhibit level of

Table 4.3

Proportion of Children Dead by Age of Mother and Place of (Awraja) Residence, Shewa, 1984.

Place of (Awraja) Residence	Age group of mother					
	Total 15-49	20-24	25-29	30-34	35-39	40-44
SHEWA	.1806 (226040)	.1504 (18554)	.1553 (35653)	.1700 (46016)	.1794 (49505)	.2019 (42813)
TEGULET-BULGA	.1084 (12542)	.0623 (850)	.1216 (1455)	.0841 (2569)	.1063 (2935)	.1116 (2446)
SELALE	.1412 (14054)	.1270 (1205)	.1102 (2104)	.1215 (2939)	.1570 (2910)	.1539 (2654)
MENAGESHA	.1430 (19486)	.1141 (1638)	.1221 (2809)	.1350 (3800)	.1368 (4277)	.1640 (4069)
YERER-KEREYU	.1520 (17135)	.1249 (1937)	.1383 (3151)	.1221 (3481)	.1501 (3358)	.1928 (2868)
JIBAT-MECHA	.1528 (21157)	.1515 (1650)	.1589 (2864)	.1556 (3825)	.1319 (5011)	.1585 (4302)
MENZ-GISHE	.1691 (6469)	.1440 (639)	.1577 (1021)	.1593 (1375)	.1872 (1271)	.1706 (1149)
MERHABETE	.1767 (6705)	.1384 (578)	.1601 (993)	.1650 (1412)	.1748 (1224)	.1969 (1473)
GHEBO-GURAGE	.1984 (35748)	.1900 (1942)	.1634 (5190)	.1827 (7290)	.1946 (8616)	.2174 (7594)
KEMBATA-HADIYA	.2029 (41033)	.1674 (3153)	.1651 (6621)	.1919 (8362)	.2015 (9329)	.2281 (7441)
YIFAT-TIMUGA	.2121 (9102)	.1635 (850)	.1708 (1259)	.2068 (1920)	.2018 (1799)	.2533 (1847)
HAIKOTCH-BUTAJIRA	.2164 (42609)	.1697 (4112)	.1733 (8186)	.2133 (9043)	.2271 (8775)	.2519 (6979)

Note: Figures in parenthesis refer to the number of children ever born to respective age group of mother.

source: As in table 4.1

child mortality higher by 55 percent (.2068/.1331) when compared with the three central *Awrajas*.

The small land holding in the three southern Awrajas is compounded by the scatter of the plots and warm to hot climate. In contrast, the low to medium population densities in the three central Awrajas together with temperate climate is probably more favourable for child survival in the region. The issue is addressed in table 4.3. When attempt is made to control for education some frequencies were rendered unstable.

4.5 Ethnicity, Religion and Child Mortality

According to the upper panel of table 4.4 a Gurage child is 44 percent (.2187/.1522) more likely to die than an Amara child and 28 percent (.2187/.1702) more than the Oromo. On the other hand, child mortality among the Oromos is 12% (.1702/.1522) higher than among the Amaras. When one of the modernizing factors, education is controlled (see the lower panels of table 4.4) an interesting result emerges. For schooled women, while the child mortality advantage of Amara mother over that of her Oromo sister virtually vanishes that with the Gurage is depressed by only 7 percent. For mothers with no schooling, the original relationship persists. We argue that part of the excess mortality might have to do with location of Awraja residence. As we have seen in table 4.3, southern Shewa, mostly inhabited by the Gurages, had the highest child mortality. Part of the

Table 4.4

Proportion of Children Dead by Ethnicity, Educational Status and Age of Mother, Shewa, 1984.

Mother's educational status/ ethnicity	Age-Group of Mother					
	Total 15-49	20-24	25-29	30-34	35-39	40-44
Total						
Amara	.1522 (48100)	.1303 (3992)	.1428 (6902)	.1380 (9950)	.1529 (10377)	.1646 (9220)
Oromo	.1702 (89505)	.1447 (7638)	.1484 (13710)	.1645 (17515)	.1680 (19273)	.1859 (17558)
Gurage	.2187 (35489)	.1958 (2012)	.1818 (5592)	.1983 (7632)	.2133 (8507)	.2477 (7084)
Others	.1984 (52946)	.1572 (4912)	.1587 (9449)	.1880 (10919)	.1976 (11388)	.2353 (8951)
Some Schooling						
Amara	.1213 (5810)	.1398 (794)	.1143 (1198)	.1049 (1468)	.1313 (1172)	.1587 (630)
Oromo	.1261 (3995)	.1115 (592)	.1208 (861)	.0829 (893)	.1289 (729)	.1862 (392)
Gurage	.1658 (1508)	.1592 (201)	.1371 (299)	.1662 (355)	.1855 (372)	.1524 (105)
Others	.1285 (4558)	.1053 (912)	.1154 (1222)	.1393 (976)	.1329 (662)	.1653 (375)
No Schooling						
Amara	.1564 (42290)	.1279 (3198)	.1488 (5704)	.1437 (8482)	.1557 (9165)	.1651 (8590)
Oromo	.1722 (85510)	.1474 (7046)	.1503 (12849)	.1689 (16622)	.1695 (18544)	.1859 (17166)
Gurage	.2211 (33981)	.2000 (1811)	.1844 (5293)	.2000 (7277)	.2146 (8135)	.2492 (6797)
Others	.2049 (48388)	.1690 (4000)	.1652 (8227)	.1928 (9943)	.2016 (10726)	.2383 (8576)

Note: Figures in parenthesis indicate the number of children ever born to the respective age group of mother

Source: As for table 4.1

difference among the three ethnic groups could be explained by cultural factors in child birth and rearing practices.

Table 4.5

Proportion of Children Dead by Religion, Education and Age of Mother, Shewa, 1984.

Mother's Educational Status/Religion	Age group of mother					
	Total 15-49	20-24	25-29	30-34	35-39	40-44
Total						
Christians	.1629 (155721)	.1352 (12285)	.1408 (23255)	.1493 (30819)	.1620 (34974)	.1831 (30555)
Moslems	.2193 (68356)	.1798 (6005)	.1811 (11999)	.2104 (14827)	.2206 (14166)	.2494 (12004)
Schooling						
Christians	.1209 (12441)	.1115 (1883)	.1106 (2767)	.1074 (2971)	.1304 (2278)	.1597 (1246)
Moslems	.1617 (1973)	.1473 (387)	.1351 (407)	.1663 (421)	.1813 (364)	.1842 (152)
No Schooling						
Christians	.1665 (143179)	.1396 (10385)	.1449 (20481)	.1538 (27807)	.1642 (32693)	.1841 (29300)
Moslems	.2210 (66357)	.1818 (5609)	.1828 (11587)	.2116 (14406)	.2216 (13802)	.2504 (11842)

Note: Figures in parenthesis indicate the number of children ever born to the respective age group of mother.

Source: As for table 4.1.

Child mortality conditions appear to have been more favourable for the Christians than for the Moslems by 35 percent (.2193/.1629) (table 4.5). The difference is invariably reflected across all age groups. The lower panels of the table suggest that although mortality is drastically reduced for both Christian and Moslem mothers with some schooling, difference in child mortality between the two religious categories is not mediated by education in Shewa region. To find out whether or not this last conclusion is in fact an artifact comparison of child mortality for higher educational category (grade 5 or above) for Christians and Moslems is made. No attenuation of the relationship is observed.

4.6 Marital Status and Child Mortality

The favourable mortality advantage enjoyed by children of currently married mothers over those of children of widowed, divorced and separated together is confirmed by table 4.6. The relationship holds across all age groups of mothers. The result in the first panel demonstrates that while child mortality between the married and never married (single) remain about the same, children of widowed, divorced and separated women together run a 20 percent (.2127/.1772) higher mortality risk when compared with the married category. When direct standardization, taking the distribution of CEB in the region as a standard, is applied, however, the currently married women show undisputed child mortality advantage. It is only in this section where standardization reverses the relationship among the categories. Because of the stigma attached to single women having children and their small number (no dead

Table 4.6

Proportion of Children Dead by Marital Status and Age of Mothers, Shewa, 1984.

Educational Status/ Marital Status	Age group of mother					
	Total 15-49	20-24	25-29	30-34	35-39	40-44
Total						
Never married	.1749 (1623)	.1726 (301)	.2048 (249)	.1399 (286)	.1489 (188)	.2200 (200)
Currently married	.1772 (203087)	.1492 (17152)	.1548 (33698)	.1686 (42864)	.1759 (44675)	.1987 (36864)
Widowed/ Divorced/ Separated	.2127 (21324)	.1635 (1095)	.1583 (1706)	.1936 (2866)	.2148 (4642)	.2216 (5749)
Schooling						
Never married	.1517 (336)	.2400 (100)	.2000 (50)	.0860 (23)	0 (26)	0 (2)
Currently married	.1229 (12618)	.1080 (2018)	.1126 (2921)	.1139 (3089)	.1340 (2171)	.1604 (1166)
Widowed/ Divorced/ Separated	.1502 (1558)	.1621 (185)	.1091 (220)	.1221 (303)	.1615 (452)	.1739 (230)
No Schooling						
Never Married	.1810 (1287)	.1393 (201)	.2060 (199)	.1445 (263)	.1728 (162)	.2222 (198)
Currently Married	.1809 (190381)	.1547 (15114)	.1588 (30768)	.1729 (39742)	.1781 (42501)	.2000 (35698)
Widowed/ Divorced Separated	.2177 (19733)	.1637 (910)	.1652 (1483)	.2019 (2555)	.2205 (4190)	.2238 (5500)

Note: Figures in parenthesis indicate the number of children ever born to the respective age group of mother.

Source: As for table 4.1

children were reported in some cells), the proportion dead for this category is probably spurious.

Controlling for education, for women with some schooling, currently married women have the lowest child mortality of all marriage categories. In both urban and rural areas similar pattern in favour of married women is revealed. All said, currently married women have a decided child mortality advantage over other marriage categories in all women groups examined above.

4.7 Place of Birth of Mother and Child Mortality

Table 4.7 suggests that the incidence of child death is higher by 19 percent (.1815/.1522) among women born in rural than in urban areas. To avoid the possible association of urban-rural birth with urban-rural residence, the relationship is re-examined in urban and rural current places of residence separately. The same pattern holds in both, although the gap in mortality difference is wider in rural place of residence (27%) than in urban (16%). Based on the consistency of the relationship and following the UN(1985), we argue that the physical, social and cultural environment of the place of birth of the mother is likely to have its own impact during her own child bearing and rearing periods. A woman born and brought up in urban areas would, in all probability, benefit from the 'urban milieu' the urban area provides.

Table 4.7

Proportion of Children Dead by Place of Residence, Place of Birth and Age of Mother, Shewa, 1984.

Place of Residence/ Place of Birth (p.b.)	Age Group of Mother					
	Total 15-49	20-24	25-29	30-34	35-39	40-44
All Shewa						
Urban p.b.	.1522 (6707)	.0808 (656)	.1252 (998)	.1237 (1366)	.1734 (1534)	.1910 (1162)
Rural p.b.	.1815 (218931)	.1528 (17870)	.1562 (34593)	.1715 (44544)	.1798 (47877)	.2022 (41607)
Urban Residence						
Urban p.b.	.1542 (5585)	.0735 (544)	.1211 (842)	.1319 (1175)	.1779 (1287)	.1948 (924)
Rural p.b.	.1786 (13000)	.1408 (980)	.1494 (2068)	.1607 (2955)	.1732 (3268)	.2164 (1996)
Rural Residence						
Urban p.b.	.1426 (1122)	.1161 (112)	.1474 (156)	.0733 (191)	.1498 (247)	.1765 (238)
Rural p.b.	.1817 (205931)	.1535 (16890)	.1567 (32525)	.1722 (41589)	.1803 (44609)	.2015 (39611)

Note: Figures in parenthesis indicate the number of children ever born.

Source: As for table 4.1

4.8 Activity Status of Mother and Child Mortality

The distinction between working and non-working women is difficult to make. For one thing, two different approaches of data collection were used in the urban and rural areas. In the urban areas, any person 10 years and over was considered working

if he/she had been engaged in 'productive activity' in any one of the seven days prior to the Census date. In the rural areas, on the other hand, a person was considered working if he/she had been engaged in 'productive activity' during most of the previous 12 months. 'Productive activity' especially in rural areas itself is far from precise. Accordingly, all females (above 10 years) who fulfil the above criteria and those who were temporarily absent from their activity were classified as working. In particular, housewives who normaly participated in domestic activities were classified as not working.

Perhaps not surprisingly, the result is also mixed. The anticipated higher proportion of dead children for working women, since their children are assumed to receive less care and breast feeding, is not found. On the contrary, women not working show a 21 percent (.2002/.1655) excess child mortality over their working colleagues. This is addressed in table 4.8. If we were to follow another route and argue that working women are better educated , this is not reflected for the better educated women. In the Urban areas too, working women report higher proportion of children dead. We believe that the nature of data on this issue does not warrant any meaningful conclusion regarding the relationship between activity status and child mortality.

Table 4.8

Proportion of Children Dead by Residence, Work Status and Age of Mother, Shewa, 1984.

Residence/ work status of mother	Age-Group of Mother					
	Total 15-49	20-24	25-29	30-34	35-39	40-44
All Shewa						
Working	.1655 (127696)	.1435 (10260)	.1463 (18661)	.1547 (25575)	.1648 (28561)	.1798 (24853)
Non Working	.2002 (98344)	.1590 (8294)	.1652 (16992)	.1891 (20441)	.1994 (20944)	.2323 (17960)
Urban						
Working	.1891 (5959)	.1517 (435)	.1436 (745)	.1571 (1095)	.2038 (1688)	.2235 (1038)
Non Working	.1620 (12852)	.1060 (1113)	.1390 (2201)	.1498 (3098)	.1559 (2919)	.2006 (1899)
Rural						
Working	.1643 (121737)	.1431 (9825)	.1464 (17916)	.1546 (24480)	.1624 (26873)	.1780 (23815)
Non Working	.2059 (85492)	.1672 (7181)	.1691 (14791)	.1961 (17343)	.2064 (18025)	.2361 (16061)

Note: Figures in parenthesis indicate the number of children ever born to the respective age group of mother.

Source: As for table 4.1

4.9 Sex of Children and Child Mortality

The excess male over female child mortality presented in table 4.9 does not show any peculiar feature beyond the general pattern observed in most human populations. This is replicated in all age groups, both in urban and rural areas and across the educational categories. Controlling for education, the most important variable affecting child mortality, does not change the result. In many traditional societies, the preference of males over females is related to agricultural activities. If

Table 4.9

Proportion of Children Dead by Education, Sex, Residence and Age of Mothers Shewa, 1984.

Education of mother/ Sex / Residence	Age Group of Mother					
	Total 15-49	20-24	25-29	30-34	35-39	40-44
Total						
Male	.1897 (118637)	.1551 (9665)	.1582 (18577)	.1793 (24207)	.1899 (25789)	.2141 (22631)
Female	.1705 (107403)	.1453 (8889)	.1522 (17076)	.1596 (21809)	.1681 (23716)	.1882 (20182)
Schooling						
Male	.1367 (7489)	.1264 (1163)	.1228 (1677)	.1277 (1801)	.1556 (1337)	.1623 (731)
Female	.1156 (7023)	.1096 (1140)	.1037 (1514)	.0998 (1614)	.1189 (1312)	.1619 (667)
No Schooling						
Male	.1933 (111076)	.1590 (8486)	.1617 (16897)	.1835 (22378)	.1918 (24451)	.2158 (21890)
Female	.1743 (100325)	.1507 (7739)	.1569 (15553)	.1644 (20182)	.1710 (22402)	.2128 (19506)

	Urban		Rural	
	Male	.1812(9694)	Male	.1905(108943)
	Female	.1593(9117)	Female	.1715(98286)

Note: Figures in parenthesis indicate the number of children ever born to the respective age group of mother.

Source: As for table 4.1

this had been the case in Shewa, relatively higher proportion of female children would have died in rural than in urban areas. When urban-rural residence is controlled (see last panel of table 4.9), however, no such pattern is detected. Therefore, all said and told, there is no evidence of sex preference that leads to the deprivation of any one sex.

CHAPTER FIVE

DETERMINANTS OF CHILD MORTALITY IN SHEWA
A MULTIVARIATE APPROACH

5.1 Introduction

In chapter four, attempt was made to assess the importance of the different variables in triggering a change in the level of child mortality in Shewa region. This approach basically consisted of a uni- and bivariate comparison of the proportion of dead children among different population groups which were categorized along one or two socio-economic variable(s). Because of the complex and multi-faceted association of child mortality with all the various factors and the interrelationships among the socio economic factors affecting child mortality themselves, it is hard to determine the relative importance each factor exerts on child mortality in a uni and bivariate analytical techniques.

The increasing desire to get a better insight into the nature of the association between child mortality and the various factors on the one hand and among the factors themselves on the other counterposed with the inadequacy of the traditional approach to face up to this task, has led to the development and application of multivariate techniques in recent years. Multiple linear regression has been increasingly used for analysing the determinants of child mortality in exactly the same

context we are now using it. In order to determine the importance of the independent (explanatory) varaibles together as a group and the contribution of each separately, the approach used by Farah and Preston (1982) in child mortality analysis in the Sudan and that used by the UN(1985) in a comparative study of child mortality for fifteen developing countries is adopted in this study. Furthermore, the procedure enables to get an insight into the nature of association among the explanatory variables themselves.

In the next few pages, the determinants of child mortality in the region are re-examined in a linear regression analysis. According to Farah and Preston (1982:368) a determinant of child mortality is a variable that would, directly or through other intermediate factors (indirectly), change child mortality if its own value were altered.

5.2 The Model Used

Before fitting the regression model, an adjustment concerning the dependent variable, for the effect of the assumption we made in the course of estimating the levels of child mortality, is in order. It was assumed that the risk of dying of a child is a function of the length of exposure to the risk which in turn depends upon the age of the mother (Brass and Coale, 1968). As we have already seen, the proportion of dead children as well as the age of children was expected to increase with the age of mother. Therefore, only because of their age, older women compared to their

younger colleagues, on the average, are bound to have higher proportion of dead children which may not in whole or in part be attributed to any change in the determinants of child mortality. Since the idea here is to find out if there is difference in child mortality brought about by variation in socio-economic variables and not by age of the mother, the difference that already existed in child mortality arising out of the age of the mother must be controlled or nuetralized. If that is not done, the result of the regression analysis would be seriously impaired.

According to a method developed and tested by Trussell and Preston (1982), the effect of the age of mother on child mortality is controlled by constructing an index of child mortality as a ratio of the actual proportion of her dead children to the proportion expected to die whose value is based on the age of the mother and actual child mortality condition in the society. The index of child mortality (child mortality ratio) for women i of age group j is thus

$$PD_i \; / \; EPD_j \text{ , where}$$

PD_i = Proportion of dead children to women i

EPD_j = Expected proportion of dead children for woman i based on her age group j (j=1,2,...,7 and 1=15-19, 2=20-24,..., 7=45-49).

EPD_j, in turn, is estimated by inverting the original Brass equation

$$q^s(x) = EPD_j k(j) \text{ to}$$

$$EPD_j = q^s(x)/k(j), \text{ where}$$

$q^s(x)$ is a 'standard' life table mortality measure based on our own estimation in

chapter 3 which was level 15 for urban and 14.35 for rural areas in the North model of Coale-Demeny model life table system. k(j) is the corresponding Trussell multiplier for each quinquennial age group of mother (see annex I). Theoretically, the average value of the child mortality ratio should be equal to unity provided the appropriate mortality schedule is selected.

The multiple regression equation with 'Child Mortality Ratio' as a dependent variable has the following form

$$\frac{PD_i}{EPD_j} = A + B_1 X_{i1} + B_2 X_{i2} + \ldots + \epsilon_i$$

where x_{i1} = value of variable 1 for women i

x_{i2} = value of variable 2 for women i

A = a constant

ϵ_i = error term

The partial regression coefficients (B_i's) show the proportionate change in child mortality brought about by a unit change in each of the independent variables (for dummy variables, the proportionate change as a result of a membership in a category relative to being in the reference category) after statistical adjustments are made for all other variables.

A highly significant linear relationship between the dependent variable on the

one hand and each set of the independent variables on the other, for all the regression equations used, is testified by an F-test associated with analysis of varaince table. Moreover, the correlation matrix and 'tolerance' together for each equation point to rather low degrees of asociation among most of the independent variables. The average value of the child mortality ratio (PD_i/EPD_j) for the region and rural areas is found to be 0.986 while for the urban it is 0.996. The degree of closeness of these results, especially for the urban areas, to the theoretical value of 1 is a clear testimony to the adequacy of the model mortality schedules selected for both urban and rural areas of Shewa (levels 15 and 14.35 in the North model for the urban and rural areas respectively).

5.3 The Socio Economic Determinants

For a meaningful multivariate regression analysis of child mortality, diversity of the population under study is necessary. On the contrary, the population of Shewa region tends to be homogeneous with regard to the important socio economic characteristics, especially education (we noted earlier that only less than 7% of the women in the rural areas had any form of schooling at all). Consequently, regression results for the region as a whole show a very low coefficient of determination (R^2) and the response in R^2 as a result of adding more variables like education to some already existing was also very low (see annex table IV).

Although the urban areas in the region are little different from the rural hinterland, we nevertheless, think that more differentiation among certain variables, like education does exist. After excluding all women with zero parity, parity not stated and others whose records were not complete on any of the variables of interest, the analysis is based on 4,101 women between ages 20 and 44 years. The mortality experience of young women in the age group 15-19 years is usually suspect and out of line. Indications of omission errors in our data for women of 45-49 years is in parallel to the general notion that estimates based on the experience of old women too is unreliable. Hence the two age groups are excluded from the analysis. A three stage plan of regression analysis is, therefore, pursued for the urban sub-sample using the same seven independent variables. A fourth equation, by subtracting the *Awraja* residence variable from the complete model, was later added.

The first three stages are ordered in some general sequence of occurance of the variables of interest. In the first stage, child mortality is regressed on three variables normally acquired at the earliest phase of the mothers life and include place of birth (urban or rural), ethnicity and religion. All the three variables are categorical. The signs of both the regression and beta coefficients are in accordance with expectations and all highly significant both at .01 and .05 levels. Any interaction/association among the three independent variables, as suggested both by the 'tolerance' and correlation matrix, are very low (see annex table III).

The regression coefficients contained in table 5.1 show that women born in the urban areas have 13 percent more child survival advantage over those born in the rural areas, after the effects of religion and ethnicity on child mortality are controlled. The corresponding figure in the rural areas is 16.7 percent (see annex table II). Also child mortality is about 29 percent higher for Gurages and 11 percent for Oromos when compared with Amaras after the effects of place of birth and religion, in turn, are held constant. Furthermore, controlling for place of birth and ethnicity, Moslems in urban areas suffer from 16 percent excess child mortality. The direction of the relationship between child mortality and each of the social variables is very much in agreement with our previous findings in chapter four, although the magnitudes are less amplified, but more reliable. This is as it should be, because in the regression analysis, the influences of many variables are simultaneously controlled. In terms of the beta coefficients, which are often used to compare the relative importance of each of the variables in the regression equation, belonging to Gurage ethnic groups followed by urban place of birth account for more variation in child mortality.

In the second stage, education of mother is added to the variables that already existed in the first stage. In terms of both the regression and beta coefficients, education of mother (schooling, no schooling) is at once the most important variable in depressing child mortality. The result suggests that controlling for religion, ethnicity and place of birth, children of mothers with no schooling are 30 percent more likely to die than children whose mothers completed at least grade one. The effects of

Table 5.1

Effects of the Different Variables on Child Mortality. Regression and Beta Coefficients Shewa, 1984 (Urban)

Independent Variables	Stages				Beta coefficinets corresponding to stage III
	I	II	III	IV	
Place of birth (Rural=0)					
Urban	-.13367	-.09445	-.11828	-.10680	-.0402
Religion (Christians=0)					
Moslems	.16471	.12716	.14961	.14688	.0360
Ethnicity (Amara=0)					
Gurage	.28775	.27441	.17933	.28939	.0465
Oromo	.11317	.07791	.07674	.08431	.0243
Education (Schooling=0)					
No Schooling		.30135	.21297	.29288	.0776
Marital Status (Married=0)					
Never Married			.48394	.48204	.0246
Wid/Div/Sep			.12185	.10635	.0363
Work Status (Working=0)					
Not Working			-.10304	-.11515	-.0353
Awraja Residence (Selale=0)					
Merhabete			.07419**		.0078**
Menz			.18836**		.0161**
Yifat			.52743		.0884
Tegulet-Bulga			-.00192**		-.0003**
Yerer-Kereyu			.08186**		.0283**
Haikotch-Butajira			.41489		.1259
Chebo-Gurage			-.03274**		-.0039**
Menagesha			-.12612*		-.0349*
Jibat-Mecha			.01170**		.0022*
Constant	.9480	.77178	.75701	.82593	
R^2	.01033	.02202	.04821	.02723	
Adjusted R^2	.01009	.02171	.04719	.02674	

Note: ** F ratio not significant at .05 level
* F ratio not significant at .01 level

religion, place of birth and ethnicity, except for the Gurages, are somewhat toned down when education is introduced into the regression equation showing that some of the influences on child mortality of the variables is through differences in educational opportunity. Perhaps surprisingly, both regression and beta coefficients for the Gurage ethnic group hardly change with the introduction of the education variable suggesting that mortality condition in this ethnic group is not influenced by education. This finding buttress our earlier conclusion in chapter four. It may be remembered that when education was controlled in the bivariate section the difference between the Amaras and Oromos almost disappeared while that of Gurages with Amaras persisted.

The coefficient of determination (R^2) doubled when education is introduced in the second stage whereas it barely changes in rural areas. The observed weaker relationship in rural areas is due mainly to the low level of education. It may be recalled that only less than 7 percent of the women had any form of schooling. Religion in rural areas explains more of the variation in mortality than education.

When a trichotomus educational category is used women who completed grade five or above exhibit much reduced child mortality, by 38 percent compared with the illiterate women suggesting that higher education is more conducive to lower child mortality. Those who completed grades one through four show only 28 percent lower child mortality. All the variables in this second stage remain significant both at .05

and .01 levels.

After including the remaining variables of *Awraja* residence, marital status and activity status in the third stage, child mortality is regressed on all the seven variables. The significant linear relationship between the dependent variable and the entire set of the independent variables is still maintained. The value of R^2 is again more than doubled in the urban areas and increased by more than 67% in the rural (see annex table II). In the region as a whole (see annex IV), after controlling for all other variables, child mortality in each of the three southern *Awrajas* of Haikoch-Butajira, Kembata-Hadiya and Chebo-Gurage is far in excess of that in Selale (central) by 26, 21 and 14 percent respectievly. Confirming to our prior expectation, Tegulet-Bulga (another central *Awraja*) maintains child mortality advantage in relation to Selale. Earlier, we found that Tegulet-Bulga had the lowest child mortality in Shewa region. This result clearly tallies with our previous findings in this respect. Although *Awraja* residence appears to explain a substantial part of the variation in child mortality, in the urban areas too, about half of the *Awrajas* do not show any significant relationship with child mortality.

Following the introduction of the last set of variables, the influences of both education and belonging to Gurage ethnic group are substantially reduced, although both remain sufficiently important. Amazingly, the original strength of the above two variables are restored again only when the Awraja residence variable is dropped from

the full model.

In terms of the beta coefficients (see last column of table 5.1), the cutting edge of the education variable remains intact. The most revealing aspect of this last statement is that a substantial part of the influence of education and higher child mortality of the Gurage ethnic group are explained by regional differences in child mortality. As we mentioned earlier the Gurages live in the high mortality section of Southern Shewa. In other words, *Awraja* residence explains a good part of the variation in child mortality in Shewa region. *Awraja* residence is not as such a determinant of child mortality. Rather it could be viewed as a mediater for other undefined or ill defined factors. Although data in our hand does not allow to make further explanation at this stage, the result is in tune with evidences from other African countries (Farah & Preston, 1982; Kibet, 1987). Differences in disease pattern and disparity in the distribution of social and economic benefits could be some of the reasons for the observed difference. The strength of the relationship between *Awraja* residence and child mortality in Shewa warants an investigation into the intermediate variables that directly affect child mortality.

Child death for never married women in urban areas is raised by 48 percent compared with that of the currently married when all the remaining variables are controlled. The value of the beta coefficient for this category is even higher than for widowed, divorced and separated put together. Even though this result might look

plausible, both the direction and magnitude of the relationship is unexpected, in view of the earlier relationship between the two variables. On the other hand, 12 percent excess mortality for widowed/ divorced/ separated women in comparison to the currently married does fit with the expected pattern.

In the complete model housewives (not working) in urban areas have 10 percent lower child mortality in comparison to working mothers when the influence of all other variables are held constant. Children of non-working mothers are expected to get better care and breast feeding. On the contrary in the rural areas the opposite appears to be the case. As pointed out earlier, little confidence can be placed on this result as the concept of 'working' and 'not working' is not distinctly differentiated in the region.

5.4 The Low Value of R^2

Regarding the general low value of R^2 in the regression analysis of infant mortality, Gortmaker (1979:288) had this to say. "Researchers analysing infant mortality with regression models have noted with disdain the low R^2s produced, the inference being that a low R^2 means the model has little explanatory power". In our case, there are two main reasons for the very low value of R^2 in addition to this general feature. The limited data set from the 1984 Census did not allow inclusion of almost all demographic and many socio economic determinants of child mortality.

The other compounding factor is the problem of timing and measurement raised earlier. Notwithstanding the assumption that the variable of interest existed long before the death of children, so that their effects are sufficiently felt, many variables like education, type of residence are acquired later for a substantial proportion of the women. The mass literacy campaign, for eg., targeted towards adults, is likely to diminish the cutting edge of education on child mortality. The work status of women, unlike education, can change almost at will. Then, how to measure things like status of women? etc..

One can justifiably argue, therefore, that in the absence of these types of distortions, which can be substantially controlled in a specialized survey, the explanatory power of the equations would be much higher than indicated.

5.5 The Alternative Approach

As an afterthought, the logit model was fitted to the data of Shewa region. The average value of child mortality ratio of 0.986 for the region was used as a cut of point for creating a dichotomus dependent variable. The logit coefficients are invariably larger than the linear regression coefficients as they should be, since the former indicates the proportionate effect of being in a category on the ratio of probability of dying to the probability of surviving, whereas the latter simply on probability of dying (UN, 1985). The signs, except for urban-rural residence variable,

are all in the expected direction and except for Oromo ethnicity, similar to the regression coefficients (see annex table V). All variables, excepting the categories for Oromo, never married and *Awraja* residence of Menagesha, are significant at .01 level.

In terms of the R statistics, which looks into the partial correlation between the dependent variable and each of the independent variables, to be located in one of the southern *Awrajas*, especially Haikoch-Butajira and Kembata-Hadiya greatly lowers the chances of child survival in comparison with Selale (central *Awraja*). On the other hand, in keeping with earlier conclusions, Tegulet-Bulga *Awraja* enjoyes the lowest child mortality.

The dummy coefficient for education is positive and highly significant, suggesting that, to the extent other variables are constant, to be an illeterate mother considerably raises the probability of child death. The more favourable child mortality of Christians over Moslems, Amaras over Gurages and the married over other marriage categories are evident when the remaining other variables are controlled in each case. With a remarkable consistency, our exercise in logit regression only buttress our earlier conclusions.

CHAPTER SIX

SUMMARY AND CONCLUSIONS

6.1 Summary

From the limited studies, all the indications are that levels of infant and child mortality in Ethiopia are believed to be among the highest in the world. As in many developing countries, the other distinct feature of mortality is the existence of considerable difference in chances of survival among children of different population subgroups. In spite of the foregoing, however, evidence regarding the different aspects of infant and child mortality had been far from sufficiently documented in the country.

In an effort to fill some of the yawning gaps, this study sought first, to determine levels and trends of infant and early childhood mortality in Shewa region using the Trussell version (1975) of the Brass method as well as the Coale and Trussell procedure (1977). Secondly, attempt was also made to find out the variation in mortality that existed among children of different population groups. The latter essentially consisted of univariate and bivariate comparison of proportion of dead children belonging to various categories of women differentiated along certain socio economic and demographic factors. This was closely followed by multivariate investigation of the determinants of child mortality in the region.

For the purpose of this undertaking, data from the 1984 Population and Housing Census of Ethiopia for Shewa region was utilized. With all its climatic and cultural diversity as well as its immense population size, Shewa provided an ideal setting for the study. A five percent sample consisting of 80,528 women between ages 15 and 49 years, each along with the associated characteristics, was selected. Because of the known limitations of the data set, care was taken in the interpretation of the results.

Analysis of data reveals that infant mortality rate (IMR) is estimated as high as 101 infant deaths per 1000 live births. The corresponding child mortality is 73 deaths out of 1000 children between exact ages of 1 and 5 years. When the two results are combined, 167 children (17%) fail to celebrate their fifth birth day out of an initial 1000 births. Some disparity in infant and early childhood mortality is observed between the urban and rural areas and between male and female children. Under five mortality rate is 168 for the rural and 146 for the urban areas. For male and female children, it is 163 and 145 respectively. It is important to note that these various infant and child mortality estimates made by the Trussell version of the Brass method should be regarded as the lower limits of mortality levels in the region. Although it is safe to assume that Shewa is a relatively advantaged region, its level of mortality compares unfavourably with those in many African countries with data from the first half of the 1980's.

Comparison of three sets of data from National Sample Survey of 1970, the 1981 Rural Demographic Survey and the Population and Housing Survey (1984) together does not suggest any trend in child mortality. In fact, the three sets of data do not seem to be comparable. Further examination of trends of child mortality in the region is made by employing the Coale-Trussell indirect estimation procedure. When the reports of very young and old women are disregarded, child mortality appears to have remained constant in the 1970s fluctuating around 160 under five deaths per 1000 live births. Ignoring the casual appearance of a tendency to increase in child mortality, based on the consistency checks we made, therefore, we conclude that there was no improvement in child mortality in the recent past.

When attention is focused on the differences in chances of child survival that existed among different socio economic categories of women, some interesting results do emerge. The expected strong and persistent negative relationship between education of women and child mortality is evident. Women who have had some type of formal schooling exhibit a 46 percent child mortality advantage over their unschooled counterparts. The relationship holds across all age groups of mothers. Even when urban-rural residence is controlled, the intensity of the relationship does not diminish. In fact, the uneducated women in the urban areas do not appear to benefit from the comparatively lower level of child mortality in urban areas. On the contrary, they reported proportionately higher child death than their fellow sisters in rural areas. Conversely, the schooled women in urban areas reported lower child

mortality than their counterparts in the rural setting. This might be an indication that skill and knowledge of child care and use of the concentrated urban facilities by educated mothers are put to a greater advantage in urban than in rural areas. For the uneducated women, on the other hand, the congestion and lack of hygiene might pose even more threat in urban areas. Further, it is observed that women who could only read and write through traditional education and mass literacy campaign have a mortality regime more akin to the illiterate group.

In the second stage of a regression analysis, controlling for place of birth, religion and ethnicity of the mother simultaneously, children of mothers with no schooling are 30 percent more likely to die than children of their schooled peers. Moreover, the influences of religion, place of birth, ethnicity, except for the Gurages are diminished when educational variable is added into the regression equation containing the first three variables in the first stage of the regression. This shows that some of the influences of these variables are through differences in educational opportunity. Surprisingly, both regression and beta coefficients for the Gurage ethnic group hardly change when education is introduced as a covariate, suggesting that mortality condition in this ethnic group is not much influenced by education.

One of the most revealing aspects of the differential analysis is the strong regional difference in child mortality prevailing in Shewa administrative region. Child mortality is 55 percent higher in the three southern *Awrajas* of Haikoch-Butajira,

Kembata-Hadiya and Chebo-Gurage than in the three central *Awrajas* of Menagesha, Selale and Tegulet-Bulga. The very high population densities in the southern *Awrajas* compounded by small, scattered plots of agricultural land and warm to hot climate as well as the associated disease environment could be less favourable to child survival.

When the effects of all other variables on child mortality are held constant, mortality in each of the three southern *Awrajas* of Haikotch-Butajira, Kembata-Hadiya and Chebo-Gurage is far in excess of that in Selale (central province) by 26, 21 and 14 percent respectively. In the urban areas, the strength of education and belonging to Gurage ethnic group on mortality is substantially curbed following the introduction of the *Awraja* residence variable, implying that even some of the impact of education is explained by regional differences. When *Awraja* residence alone is excluded from the full model, R^2 dropped by 43 percent. All said and told, *Awraja* residence is one very important factor explaining the variation in child mortality in Shewa region. Although data in our hand does not allow to make further investigation, differences in disease pattern and disparity in the distribution of social and economic benefits could be some of the reasons for the observed differences.

The urban-rural difference in child survival is very small. In fact, when education is controlled, it vanishes all together for schooled women and the relationship even reverses for the uneducated women in favour of rural areas.

Perhaps, it may be relevant to mention that the so called urban areas which exclude Addis Ababa are little different from the hinterland.

The Gurage ethnic group has the highest child mortality in Shewa region. A gurage child is 44 percent more likely to die than the Amara and 28 more than the Oromo. For schooled women the distinction between Amaras and Oromos virtually vanishes while that of the Gurage with the former hardly changes. The decline of the regression and beta coefficients for Gurage ethnic group as a result of the *Awraja* variable, we raised earlier, explains that part of the high child mortality of the Gurages is due to the higher mortality environment they live in. It may be recalled that the Gurages live in the high mortality sector of southern Shewa. On the other hand, the Oromo ethnic group is not at all affected by *Awraja* residence, but only by education variable it seems.

Mortality condition also appears to have been more favourable for Christians than for the Moslems by 35 percent. The Christian-Moslem difference is only slightly mediated by education. Consequently, after controlling for all the variables in the final equation, Moslem children show 15 percent excess mortality than Christians. The ethnic and religious differences that persist, even after controlling all the important variables could be explained by inherent cultural factors in child birth and rearing practices.

Child mortality is found to be lower by about 20 percent among the currently married than among the widowed, divorced and separated put together. When education alone is controlled, the currently married in the category of women with some schooling including the never married, exhibit the lowest child mortality. When all the variables are controlled in the multivaraite regression analysis, surprisingly enough, child mortality is raised by 48 percent for never married women and 12 percent for widowed, divorced and separated category in comparison with currently married. Results from logit regression also confirm the more favourable mortality advantage of the married category. In sum, currently married women have undisputed child mortality advantage in comparison to other marriage categories.

Both the uni- and multivariate findings about the effects of urban-rural place of birth of the mother on child mortality are in parallel with each other. A univariate comparison reveals that the incidence of child death is higher by 19 percent among women born in rural than in urban areas. In the full regression model, when all other variables are controlled, urban birth of mother confers a 12 percent child mortality advantage. We may conclude that the physical, social and cultural environments of the place of birth of the mother is likely to have its own impact during her own child bearing and rearing periods. A similar conclusion has been drawn by the UN(1985) in a comparative child mortality analysis for a group of fifteen developing countries.

The distinction between working and not working is not clear, especially so in the rural areas. Not surprisingly, the results are also mixed and inconclusive both in uni- and multivariate analyses, due mainly to the problem of the definitions used regarding active and inactive persons in Ethiopia.

The observed excess male over female child mortality does not show any peculiar feature beyond the general pattern observed in most human populations. Controlling for education, does not appear to change the foregoing. Generally, more males than females are born. Until parity is achieved towards the middle ages, excess male over female mortality is the norm.

6.2 Recommendations

This study underscores the need for data from a more thoroughgoing and specialized survey on infant and child mortality. Although survey of this type has always been a matter of top urgency, there is no single data set that is designed with such a purpose in mind. True, this type of survey demands highly trained personnel for the design and conduct of the survey. In addition, if it is a follow up survey, it should take sometime before the data is available. But until that is done firm conclusions on some important aspects of mortality will be hard to make. The 1984 Population and Housing Census, on which this study is based, like the other surveys before it, is multi-purpose understandably designed to address broad issues and hence

provided only limited opportunity for the study of infant and child mortality. Most pertinent demographic and some socio economic variables are not included in the census. Also accessibility to data collected by the various agencies, especially the CSA should be much easier than is the case now.

In spite of the limitations of data, the study provides evidences on important points. Notwithstanding the limited educational opportunity in the region, the role of education in depressing infant and child mortality is evident. The government should pursue, with renewed vigor, expansion of educational opportunity, beyond the on going literacy campaign, especially for women side by side with expansion of health care measures. Intervention programmes solely based on the expansion of health care services may not reach their intended goals. A similar observation has been made by Mosley(1984) stressing the need for consideration of other socio economic variables beyond the bio-medical risk factors whose only solution is often seen in terms of health intervention programmes.

Our result suggests a strong regional difference in child mortality in Shewa region which could be a mere reflection of similar patterns elsewhere in the country. This could be attributed to differences in disease environment and distribution of socio economic advantages. Future study and efforts in the collection of data should look into the intermediate factors which are responsible for the regional difference in child mortality. Once the factors are identified, the government should then take

steps to redress this regional imbalance. Accelerating the process of urbanization will not only lower urban child mortality, but also fosters development in the hinterland.

The usual univariate and bivariate comparison of proportions dead children or probabilities of dying is not adequate. Future research should adopt more appropriate and more precise modes of analysis. Other multivaraite techniques like log-linear models, multiple classification analysis (MCA) and others should be assessed.

In sum, acquiring more pertinent data, adopting more appropriate techniques of analysis, expanding educational opportunities for women, remedying the regional imbalance in child mortality, based on research and accelerating the process of urbanization will go a long way in reducing child mortality in this country. Furthermore, steps to discourage marital break ups, to carry research into the cultural differences that contribute to differences in child mortality among the various ethnic and religious groups could also be regarded as steps in the right direction.

Annex Table I

Worksheets for the Computaion of Expected Proportion Dead for Each Age Group j (EPD_j)
Rural Shewa, 1984
(Based on level 14.35 in the North model and sex ratio of 110)

Age of child	Age group of mother	$q^s_i(x)$	k_j	$EPD_j = q^s_i(x)/k_j$
1	15-19	.10025	.99188	.10107
2	20-24	.12659	.93543	.13533
3	25-29	.14280	.89756	.15910
5	30-34	.16430	.93959	.17486
10	35-39	.19020	1.00468	.18931
15	40-44	.20418	.99547	.20511
20	45-49	.22054	.98159	.22468

Urban, Shewa, 1984
(Based on level 15 in the North model and sex ratio of 106)

Age of child	Age group of mother	$q^s_i(x)$	k_j	$EPD_j = q^s_i(x)/k_j$
1	15-19	.09305	1.10435	.08426
2	20-24	.11675	.97582	.11964
3	25-29	.13144	.91085	.14430
5	30-34	.15101	.94206	.16030
10	35-39	.17480	1.00223	.17441
15	40-44	.18784	.97911	.19185
20	45-49	.20337	.97889	.20775

Annex Table III

Correlation Matrix and 'Tolerance'

(First stage regression)

Urban Shewa, 1984

	CMR	PBirth	Religion	Oromo	Gurage	'Tolerance'
CMR	1.00					
PBirth	-.048	1.00				.99503
Religion	.049	.007	1.00			.96899
Oromo	.014	.038	-.076	1.00		.94561
Gurage	.076	-.063	.171	-.229	1.00	.92790

Note: Tolerance = $1 - R^2_{(i)}$, where

$R^2_{(i)}$ is the squared multiple correlation when the i^{th} independent variable is regressed on the remaining other independent variables.

Annex Table IV
Effects of the Different Variables on Child Mortality.
Regression and Beta Coefficients Shewa, 1984

Independent Variables	Stages			Beta coefficinets corresponding to stage III
	I	II	III	
Place of birth (Rural=0)				
Urban	-.11910	-.04467	-.09544	-.01320
Religion (Christians=0)				
Moslems	.28875	.28108	.15627	.05871
Ethnicity (Amara=0)				
Gurage	.09555	.08835	.08531	.02550
Oromo	-.05816	-.06759	-.02559	-.01017
Education (Schooling=0)				
No Schooling		.20366	.23409	.04777
Marital Status (Married=0)				
Never Married			.13588	.00877
Wid/Div/Sep			.16978	.03809
Work Status (Not Working=0)				
Working			-.09903	-.03994
Urban-Rural Residence (Urban=0)				
Rural			.06853	.01541
Awraja Residence (Selale=0)				
Merhabete			.13962	.01928
Menz			.09402	.01235
Yifat			.26037	.04155
Tegulet-Bulga			-.22474	-.04118
Yerer-Kereyu			.02815**	.00609
Kembata-Hadiya			.25863	.08296
Haikotch-Butajira			.21032	.06556
Chebo-Gurage			.13876	.04138
Menagesha			.01383**	.00316
Jibat-Mecha			.08287	.01944
Constant	.90155	.71670	.62140	
R^2	.01588	.01747	.02976	

Note: ** F ratio not significant at .05 level

Annex Table V

Summary Results of the Logit Regression

Variables	B	S.E.	Wald	df	Sig	R	Exp(B)
PBirth (Rural=0)	-.1401	.0328	18.2288	1	.0000	-.0079	.8692
Religion (Chirstian=0)	.1778	.0130	187.340	1	.0000	.0268	1.1946
Oromo (Amara=0)	.0271	.0150	3.2721	1	.0705	.0022	1.0275
Gurage	.1851	.0201	84.9534	1	.0000	.0180	1.2033
Education (Schooling=0)	.4188	.0219	366.091	1	.0000	.0376	1.5201
Never Married (Married=0)	.0247	.0609	.1645	1	.6850	.0000	1.0250
Wid/Div/Sep	.2459	.0173	202.817	1	.0000	.0279	1.2788
Working Status (Not working=0)	-.1839	.0107	295.453	1	.0000	-.0338	.8321
Urban-rural (Rural=0)	.1233	.0223	30.5289	1	.0000	.0105	1.1312
Merhabete (Selale=0)	.2463	.0351	49.1490	1	.0000	.0135	1.2793
Menze	.2333	.0364	41.0484	1	.0000	.0123	1.2627
Yifat-Timuga	.3867	.0319	146.525	1	.0000	.0237	1.4721
Tegulet-Bulga	-.3988	.0321	153.928	1	.0000	-.0243	.6711
Yerer-Kereyo	.0765	.0274	7.8137	1	.0052	.0048	1.0795
Butajira	.4881	.0247	389.495	1	.0000	.0388	1.6292
Kembata-Hadya	.4388	.0255	295.762	1	.0000	.0338	1.5509
Chebo-Gurage	.3385	.0259	170.653	1	.0000	.0256	1.4028
Menagesha	.0634	.0261	5.8987	1	.0152	.0039	1.0655
Jibat-Mecha	.1439	.0259	30.9615	1	.0000	.0106	1.1547
Constant	-1.0692	.0316	1142.35	1	.0000		

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DECLARATION

I, the undersigned, declare that this thesis is my work and that all sources of material used for the thesis have been duly acknowledged.

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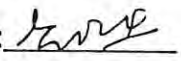
Signature: 

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