Addis Ababa University

School of Graduate Studies

College of Natural Sciences

Department of Statistics

IDENTIFICATION AND STATISTICAL ANALYSIS OF FACTORS AFFECTING USE OF CONTRACEPTIVE METHODS AMONG ETHIOPIAN WOMEN

By

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List of tables

Acronym

CSA	Central Statistical Agency
FP	Family Planning
NFFS	National Family and Fertility Survey
PRB	Population Reference Bureau
MOH	Ministry of Health
ORC	Opinion Research Corporation
EDHS	Ethiopian Demographic and Health Survey
ETR	Ethiopia Trend Report
UN	United Nation
CEB	Children Ever Born
MOHP	Ministry of Health and Population
WHO	World Health Organization
OLS	Ordinary Least Squares
ML	Maximum Likelihood
SSA	Sub-Saharan Africa

Abstract

The fertility rate in Ethiopia is very high. According to the 2000 Ethiopian Demographic and Health Survey (EDHS) an Ethiopian woman gives birth on average to 5.9 children. Problems posed by high fertility rates and population growth have sparked studies of the factors determining contraceptive usage since contraceptive is used for birth control. The major objective of this study is to determine the factors that affect the use of contraceptive methods for Ethiopian women.

The study is based on data from the 2005 EDHS with a total of 14,070 women in the age group 15-49 years. Binary logistic regression and descriptive statistical measures are used for the analysis. The binary logistic regression analysis is applied to examine the association between contraceptive usage status and women's demographic, socio-economic, and cultural characteristics.

Binary logistic regression analysis revealed that the age of a woman, place of residence, religion, partner’s education level, woman’s education, information about family planning (FP) on radio, frequency of listening to radio, visit by FP worker, region and wealth index were the most important variables that explained the variability in contraceptive usage. Women who had higher education and higher partner’s education, higher wealth status, were exposed to radio, resided in urban areas, catholic women, exposed to FP message on the radio, were visited by FP worker, aged from 25-29, and especially those who lived in Addis Ababa were more likely to use contraceptive methods.

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

The world population is increasing from time to time at unprecedented speed. From day to day it is becoming a global concern as many countries in many parts of the world face the difficulty of sustaining their population.

In most developing countries in general, and in Sub-Saharan Africa in particular, the problem of population growth and reproductive health challenges include: high maternal mortality, high population growth rate, total fertility rate and much unmet need for family planning in the world. The situation in Ethiopia is still much worse than most African countries (ETR, 2007).

Ethiopia is one of the developing countries with high growth rate of population, high level of maternal and child mortality. The population growth rate of the country is among the highest in Sub-Saharan Africa (CSA, 1999). Women in the reproductive age group (15-49), constitute a substantial percent of the total female population. Furthermore the country has a youth age structure in which 40% of the population is under age 15. This indicates that there is considerable momentum for population growth. This, together with the high level of fertility and a low level of contraceptive use, suggests that the population will continue to grow at a faster pace for at least another generation.

The practice of contraception is as old as human existence. For centuries, humans have relied on their imagination to avoid pregnancy. Ancient writing noted on the Kahun papyrus dating to 1850 BCE (Before the Common Era, substitute for

BC) refers to contraceptive techniques using a vaginal pessary of crocodile dung and fermented dough, which most likely created a hostile environment for sperm. The Kahun papyrus also refers to vaginal plugs of gum, honey, and acacia. During the early second century in Rome, Soranus of Ephesus created a highly acidic concoction of fruits, nuts, and wool that was placed at the cervical to create a spermicidal barrier (Lipsey, 2005).

Today, the voluntary control of fertility is of paramount importance to modern society. From a global perspective, countries currently face the crisis of rapid population growth that has begun to threaten human survival. At the present rate, the population of the world will double in 40 years; in several of the more socio-economically disadvantaged countries, populations will double in less than 20 years.

On a smaller scale, effective control of reproduction can be essential to a woman's ability to achieve her individual goals and to contribute to her sense of well-being. A patient's choice of contraceptive method involves factors such as efficacy, safety, noncontraceptive benefits, cost, and personal considerations (Omnia, 2010).

Rapid population growth, which in many instances far outstrips economic growth and environmental sustainability, is the reality in most developing countries of Sub-Saharan Africa. In Ethiopia the overall contraception prevalence rate among women of childbearing age (15 to 49 years) is less than 2%, and the crude birth rate is estimated to be 49 per 1000 population. Most women in Ethiopia marry by the age of 15, and less than 6% remain single by the age of 24.4 on average Ethiopian wives experience seven pregnancies during their lifetime, each pregnancy carrying about a 1% risk of death (Haile 1990, United Nations Children's Fund 1989). These figures are associated with an annual rate of population growth of approximately 3% (World Bank 1993). The aim of the program was to initiate and sustain modern contraceptive use among married couples. Because the limited research on male roles in Ethiopia and Sub-Saharan Africa has consistently found that decisions regarding family size and contraception are dominated by husbands, who desire to have large families, Mengistu and Larson (1991) undertook a field trial to determine what effect involving husbands in a community-based, home visit, health education program would have on the use of modern contraception in Ethiopia.

Traditionally, in developing countries children are considered a symbol of both social and economic well-being. This is evident from a popular saying that says, "May your progeny fill the hills and mountains." Marriage is early and universal, and it is viewed as a disgrace for a couple, particularly for the wife, not to have children. High fertility is desired because by producing children, preferably sons, a woman raises her status in the family (MOHP, 2003). Other reasons for high fertility include early and universal marriage as well as desire for sons, for both religious (to perform religious rituals) and economic (immediate economic gains and old age security) reasons (Karki, 1982).

Fertility is one of the three principal components of population dynamics that determine the size and structure of the population of a country (United Nations, 1983). Differentials in fertility behavior and fertility levels in different areas and among population strata or characteristics have been among the most pervasive findings in demography (Cochrane, 1979). It is essential to identify the risk factors associated with high fertility and to provide services to address those who are at risk. To develop effective strategies for fertility control, it is necessary to understand the factors affecting fertility. It is hypothesized that women in vulnerable groups, such as those who got married at an early age, are illiterate, are living in rural areas, are poorest, and have very little knowledge of contraceptives, have high fertility.

1.2 Statement of problems

Based on the United Nations Population Division's most recent projections, the global population could reach the 7 billion mark as early as 2011 or as late as 2015. Most of the increases in population growth can be attributed to developing countries especially in Sub-Saharan Africa (SSA) countries where fertility rates are very high. Even though population trends remain difficult to predict, it is beyond doubt that understanding global population projections requires an analysis of fertility rates.

High fertility rates could be one of the major deterrents to sustained economic growth in SSA countries. The ill-effects of population growth can be examined at macro and micro levels. At a macro level, high population growth combined with stagnant income can result in growing income inequalities, lack of economic opportunities and high level of unemployment. In SSA countries where productivity level is low, food production cannot keep up with population growth, which leads to food insecurity. SSA countries are predominantly agricultural based which puts pressure on land use. Densely populated area results in limited arable land for production and consumption (Ayoub, 2004).

Another problem created by high population growth is congestion and rapid depletion of resources, especially in developing countries where property rights governing access to resources are not well-defined. This leads to overexploitation of resources, pollution, and degradation of the environment. Moreover, pressure on limited land availability in the rural areas due to high population growth has contributed to a massive migration of peasants to urban centers. Indeed, migration to the city has led to the mushrooming of slums in the cities, which has exacerbated the problems of unemployment, lack of proper hygiene, and education opportunities.

At the micro level, high population growth leads to a more serious issue of poverty. Poorer families, especially women and marginalized groups, bear the burden of a large number of children with fewer resources per child, further adding to the spiral of poverty and deterioration in the status of women. Low levels of income among the poorer families with many children leads to inadequate food availability, which perpetuates malnutrition, which in turn accelerates high levels of infant and maternal morbidity and mortality. Among poorer families, beyond a certain family size, additional children are usually associated with lower average educational attainment and reduced levels of child health as measured by nutritional status, morbidity and mortality (Ayoub, 2004).

In countries around the world, women who are determined to limit their family size and time their childbearing will use all available means to do so; if contraception is not a viable option, women will turn to abortion even if it is illegal. Extensive evidence demonstrates, however, that when modern contraceptives are made available to women, their increased use over time replaces previous reliance on abortion and becomes the major factor associated with reduced abortion rates. Policymakers seeking to reduce the incidence of abortion would do well to address its root cause unintended pregnancy by facilitating widespread access to modern contraceptives and by promoting their effective use.

1.3 Objectives

The major objective of this study is to determine the factors that affect the use of contraceptive methods for Ethiopian women.

The specific objectives of the study are:

- To identify factors that affect or influence the use of contraceptive methods.
- To determine prevalence of contraceptive usage of Ethiopian women.
- To know regional differences in the use of contraceptive methods.

1.4 Significance of the study

It is hoped that the findings from this research could be useful in many ways. The findings could be exploited in policy making, monitoring and evaluation activities of the government and different concerned agencies.

Since the study attempts to reveal significant factors and their impact on the use of contraceptive methods, governmental and non-governmental organizations could take intervention measures and set appropriate plans to tackle the existing contraception problems. In addition to reducing fertility, contraceptive usage has also a vital role in keeping the health of mothers and infants. Particularly the results of the study will benefit family planning program administrators to reduce population growth by increasing contraceptive prevalence rate.

1.5 Limitations

The DHS are subject to the same limitations that affect other large scale surveys. These include the intimate nature of the questions, poor framing of questions, and the complexity of contraceptive practices. In addition, confining the surveys to women of childbearing age (15-49) may limit the collection of data on usage of contraceptive methods and previous practice by older women. The other limitation of the study is the problem of EDHS data in that important variables are not included in the analysis of this study because of missing values and non responses.

CHAPTER TWO

LITERATURE REVIEW

The subject of birth control conjures up a serious population problem. Population here means any number of people inhabiting a given territory or locality such as village, city, state or country. Rapid population growth and overpopulation have remained topical issues of great concern to many national governments and the international community (Lucas, 1992; Oliver, 1995; Feyisetan and Ainsworth, 1994; Cohen, 2000). Many research works including those of Foreit and Frejka (1998), Kolsand and Sherman (1998), Okoroafor (2001) are directly or indirectly associated high population growth rates, especially in the face of low productivity, with different kinds of social problems ranging from poverty, scarcity of land, hunger and environmental degradation to political instability. In order to arrest the dangers inherent in high population growth rates, many countries such as Korea, Brazil, Columbia, China, India, Bangladesh and Malawi have successfully applied family planning as a panacea (Moni, 1992; World Bank, 1994; Cohen, 2000; Chinese Embassy, 2003). Nigeria has also adopted family planning as a strategy to curb the high rate of population growth that it is presently experiencing. Several studies have revealed that inspite of the efforts made by the government in this direction, the adoption rate of modern birth-control facilities and services or family planning in Nigeria remains largely insignificant (Haub and Yanagishila, 1992, Population Reference Bureau, 2002).

Over the past 25 years the world has experienced a contraceptive revolution (Donaldson and Tsui, 1990). Contraceptive prevalence (the percentage of women of reproductive age, married or living in union, that use some type of contraceptive method) has risen from less than 10 percent around the world in the early 1960s to an estimated 55 percent in the late 1980s and early 1990s

(Bongaarts et al., 1990; Population Reference Bureau, 1992). This increase is by no means limited to the developed countries. Although prevalence levels are higher in the industrial than in the developing world (72 versus 51 percent), it is noteworthy that more than half the women of reproductive age in developing countries currently use some form of contraception (Population Reference Bureau, 1992). The importance of this phenomenon lies in the close relationship between contraceptive prevalence and fertility (Mauldin and Segal, 1988).

Birth spacing continues to be widely accepted and practiced in many African societies. Even today, one can go to remote villages throughout the continent and find women with little or no education who recognize the importance of birth spacing for the health of their children. In fact, women who fail to observe this practice in some societies may find themselves the target of scorn or ridicule by other members of the community (Caldwell and Caldwell, 1981). Although birth spacing results in a delay in pregnancy, the motivation has not been one of achieving a smaller family size. To the contrary, spacing may have arisen to enhance the probability that each child would survive through childhood and beyond. Thus, although Westerners tend to view family planning as a means of achieving a small family norm, birth spacing in Africa has been used to attain what many Africans consider the ideal large number of healthy children. Reports from the early 1980s indicated that the practice of postpartum abstinence was on the wane throughout Africa (Page and Lesthae`ghe, 1981).

A paper by Ramesh (2010) attempted to examine the demographic, socio-economic, and cultural factors for fertility differentials in Nepal. The paper has used data from the Nepal Demographic and Health Survey (NDHS 2006) and the analysis was confined to ever married women of reproductive age. Both bivariate and multivariate analyses have been performed to describe the fertility differentials. The bivariate analysis was applied to examine the association between children ever born and women's demographic, socio-economic, and cultural characteristics. Besides bivariate analysis, the net effect of each independent variable on the dependent variable after controlling for the effect of other predictors has also been measured through multivariate analysis (multiple linear regressions). The regression analysis revealed that age at first marriage, perceived ideal number of children, place of residence, literacy status, religion, mass media exposure, use of family planning methods, household headship, and experience of child death were the most important variables that explained the variability in fertility. The result indicated that women who considered a higher number of children as ideal, those who resided in rural areas, Muslim women, those who had ever used family planning methods, and those who had a child-death experience were more likely to have a higher number of CEB compared to their counterparts. On the other hand, those who married at a later age, were literate, were exposed to both (radio/TV) mass media, were rich, and were from female-headed households had a lower number of children ever born than their counterparts.

Analysis of surveys conducted in Africa has shown that the use of modern contraception generally increases, then decreases with age (Bertrand et al., 1993). Older women may also stop using contraception, believing that they are no longer at risk of becoming pregnant (Robey et al., 1992).

Education is seen as a powerful force against high fertility, because of its economic consequences. On the economic side, educating children is costly, even where schools are "free," because parents must provide books, supplies, appropriate clothing, and frequently transportation, in order for their children to attend school. Schooling also removes children from participating in the traditional household economy, thereby making children a net cost for a longer period of their pre-adult lives, and encouraging parents to invest in fewer children. Once this investment has been made and the children reach adulthood, those with higher education—and especially women with at least a primary school education—often have fewer children, in part because of the cost of educating children, and in part because of the opportunity cost of raising children as opposed to engaging in wage labor. In addition to the economic effects of education, Caldwell (1982) also notes that education often imparts Euro/American ideals to young pupils since schools in many industrializing nations closely follow the Euro/North American model of education in which high esteem is given to values such as the nuclear family, the accumulation of material goods, and the valorization of the individual over the family.

According to Martin and Juarez (1995) education is a “source” of knowledge transmission, “vehicle” of socioeconomic advancement, and a “transformer” of attitudes. In the contemporary world, any development depends on the effective transmission of new information. As a source of knowledge transmission, Martin and Juarez discuss that schooling imparts literacy skills, which enable people to process a wide range of information and arouse cognitive change that shape individuals' interaction with their surrounding environment. As a vehicle of socioeconomic development, the authors hypothesized that education not only enhances cognitive abilities, but also it opens up economic opportunities and social mobility. In the contemporary world, education credentials open the door for formal employment and for sorting individuals into the hierarchy of occupations. Martin and Juarez explain that as a transformer of attitudes, schooling's role in attitude formation goes far beyond the enhancement of conceptual reasoning and may lead to crucial transformations in aspirations and, eventually, to questioning traditional beliefs and authority of structures. Education transforms individual attitudes and values from traditional toward modern and thereby enhancing modernization, which is essential and reliable to regulate fertility. While the least educated and the best educated women share the small family norm, the gap in contraceptive prevalence between the two groups ranges from 20-50 percentage points. Better educated women have broader knowledge, higher socioeconomic status and less fatalistic attitudes toward reproduction than do less educated women. Results of a regression analysis indicate that these cognitive, economic and attitudinal assets mediate the influence of schooling on reproductive behavior and partly explain the wide fertility gap between educational strata.

Educated women are more likely to exercise the "quality-quantity trade-off" of their children. Most of these women are likely to see the benefit of their schooling; they may develop higher aspirations for their own children's schooling. It is obvious that as the number of children increases, familial resources available to an individual child decrease. Restricting the number of children is the best solution in order to have better-educated children and more familial resources per child. It would be advantageous for a woman to have fewer children that she can afford to pay for the tuition and other related fees associated with schooling, hence the trade-off between quality and quantity of children (Ainsworth et al. 1996). Bertrand et al (1993) reported a positive association between education and use of traditional contraception in some African countries surveyed by the DHS; data from other African countries reveal that the use of modern contraception also increases with educational level. Education may also affect the distribution of authority within households, whereby women may increase their authority with husbands, and affect fertility and use of family planning.

Mass media in general and electronic media in particular, have been suggested to have powerful fertility-limiting effects in many regions of the world. In most regions where mass media are thought to have affected reproductive behavior, these media have been intentionally used to influence the behavior of their audiences, inundating consumers of these media with advertisements and other messages that promote family planning practices. In Brazil, however, the electronic media historically have not been used to promote a family planning ideology or to intentionally affect individual reproductive behavior. Hence the effects of these media on reproductive behavior in Brazil are unplanned and unintentional. A micro demographic community study in northeastern Brazil designed to determine whether exposure to mass media early in the life course is linked to higher rates of contraceptive adoption and lower numbers of births at specified ages. Using evidence from qualitative data collected at the field sites, this paper also explores possible mechanisms through which mass media may be influencing reproductive behavior in the absence of overt fertility-limiting messages (Dunn, 2001).

Hamill et al (1990) studied the influence of a selected set of determinants of contraceptive method switching in rural Sri Lanka. Of interest was the question of how change in contraceptive practice at the individual level can account for patterns observed at the aggregate level. Based on calendar data on contraceptive use over a 3-year period, collected for more than 3,000 married women in a 1986 survey, the multivariate analysis shows that women who attain all or a significant proportion of their desired fertility tend to switch to more effective methods. Women who experience method failure tend to switch methods, usually to a type that is more effective. The woman's background determinants of age and education have significant effects on method switching. There is strong indication that rural couples are practicing contraception in a nonrandom fashion, switching methods in accordance with changes in their fertility motivations and contraceptive experience. Other reasons may be urban women may be more likely to use modern methods than rural women because of greater access to modern methods in urban areas (Bertrand et al., 1993).

There is an evidence for high desired family size and strong son preference among Pakistani couples. These types of preferences could be associated with the predominantly agricultural economy where children are valued highly for their contribution to farm work. As the majority of the population in Pakistan resides in rural areas characterized by inadequate basic infrastructure and social services, the low level of education and literacy, particularly in the case of women, perpetuates the gender inequality through differential access to education for boys and girls. The relatively less favorable position of women in the economic and decision-making spheres inhibits them from making choices about family size and the use of family planning methods. Under these circumstances, typically associated with low contraceptive use and high fertility, a clearer understanding of the role of social and cultural forces, jointly with the provision of family planning supply services, provides an important basis to judge the variations in contraceptive use across different population groups (Khan and Sirageldin, 1977; Nahusin, 1992; Ali and Rukanudin, 1992).

In this context, their theory is that there are five factors potentially affecting contraceptive use, in addition to the expected positive relationship of age of women, number of living children, urban residence, and education. Deriving from both the sociological and cultural perspectives (Coale and Watkins, 1986), these five factors include the extent of communication between spouses, son preference, religious beliefs, female autonomy, and family planning service supply variables. Although some women attempt to use contraception without their husband's knowledge, many forms of contraception require partner's participation or concurrence. Eighty percent of women in a Sri Lankan study of the potential demand for Norplant stated that they would need to discuss their interest with their husbands and the extent of communication was positively related to the wife's level of education (Thapa et al, 1992).

Okezie et al (2010) studied the socioeconomic determinants of contraceptive use among rural women in Ikwuano Local Government Area of Abia State, Nigeria and examined the socio-economic determinants of contraceptive use among rural women in Ikwuano Local Government Area of Abia State. The study was conducted in the four clans in the area. Ikwuano was purposively selected because of its classification as rural and high dependence on agriculture. Data for the study were collected through a service questionnaire. A total of 200 women were randomly selected from each of the four clans. Data were analyzed using descriptive statistics and Maximum Likelihood Probit regression analysis. The analysis strongly suggested that mass media messages have a powerful effect on modern contraceptive use; Exposure to mass media messages will result to greater likelihood of use of modern contraception; Education is positive in explaining women's current use of contraceptives; Educated women are more likely to appreciate the advantages of having fewer, better educated children. The Probit result further showed that the extended family system is opposed to measures that lower fertility. The family size variable showed disposition to the non-use of contraceptives. Information about contraceptives use was mainly obtained from primary health centers. The study recommended that primary health centers should be well-equipped to render family planning services.

Speizer et al (2009) demonstrated that it is common for women to report inconsistent fertility motivations and family planning behaviors, which examined inconsistencies among urban Honduran women interviewed at two points in time and presents reasons for inconsistent fertility motivations and contraceptive behaviors at follow-up.

Univariate and bivariate analyses were presented to examine inconsistencies and reasons for stated inconsistencies.

At follow-up, over half of the women using a contraceptive method said that it would be no problem if they got pregnant. Nearly half of the women changed their perceptions between baseline and follow-up. Common reasons for reporting no problem among contraceptive users were that they accepted a child as God's will or that children are a blessing, their last child was old enough and they wanted another child. Common reasons for reporting a big/small problem among non-users of family planning (who have an unmet need for family planning) were that they were not in a stable relationship, the husband was not present, and they would expect a negative response from their family.

Inconsistent fertility motivations and contraceptive behaviors are common among effective contraceptive users. Women who are using contraception and become pregnant will not necessarily report the pregnancy as unintended, given the widespread acceptance of unintended pregnancies in Honduras. Family planning providers need to recognize that fertility motivations vary over time and that women may not have firm motivations to avoid a pregnancy (Speizer et al, 2009).

Using data from the Pakistan Demographic and Health Survey of 1990-91, Naushin and Ringheim (1996) examined the effect of selected socio-cultural and supply factors on contraceptive use as reported by married women of reproductive ages. In addition to the expected positive relationship of woman's age, number of living children, education, and place of residence with contraceptive use, it is theorized that there are five factors potentially affecting fertility regulation in the socio-structural context of Pakistan. These include the extent of communication between husbands and wives, religious beliefs, female autonomy, son preference, and the family planning service and supply variables. Using logistic regression analysis, the results of the study indicated that the explanatory power of these five factors is significant in affecting the use of contraception in both urban and rural areas. While knowledge of a source for family planning is the strongest predictor of contraceptive use, husband-wife communication and religious attitudes are also significant. The fact that the inclusion of the theoretical variables dampens the predictive effect of the primary and secondary education for women leads to the speculation that while the extremely low levels of literacy among women must be addressed through government commitment to universal education, scarce family planning programme resources can be focused more effectively on promoting spousal communication, about family size and contraceptive use, and on soliciting the support of religious leaders to counteract the misperceptions about Islamic teachings on family planning and reliance on fate. With high quality and accessible services, these measures could go a long way towards providing couples with the means to meet their reproductive goals.

A study aimed to investigate contraceptive use and its determinants in Kocaeli, Turkey, concluded that increasing the education level of couples and the status of women would result in increased contraceptive use in the future. Since the contraceptive behavior of women is influenced by their husbands' attitudes, family planning programs should be focused on the needs of both partners (Vural et al, 1999).

Tawiah (1997) examined the relationship between selected demographic and socioeconomic variables and current use status of contraception using logistic regression technique. Information on current contraceptive use was provided by 3156 out of 4488 currently married women aged 15–49 interviewed in the 1988 Ghana Demographic and Health Survey. Respondents' approval of family Planning emerged as the most important predictor of current contraceptive use, followed by discussion of family planning with partner and level of education. As a policy measure, it was recommended that information, education and communication programmes on family planning should be intensified, particularly in rural areas and female education, at least up to secondary level, should be given top priority.

According to data generated from 27 DHS surveys between 1990 and 1994, unmet need for family planning ranges from 11 percent in Turkey to 37 percent in Rwanda (Casterline et al., 1997). In the same period, it was found that unmet need is most prevalent in sub-Saharan Africa. On average, the fertility level in sub-Saharan Africa could be reduced by about one birth per woman if it were possible to meet the unmet need for family planning (Robey et al., 1996).

In relation to Ethiopia a study by Antenane Korra (2002) reveals that media exposure has a profound effect on contraceptive usage. The study showed that women who are exposed to the broadcast or the newspaper have knowledge about family planning compared with women who have had no media exposure at all. The study used bivariate and multivariate analysis and the finding shows that education contributes significantly to the quality of women's lives in that improving women's access to education and encouraging continuous and constant exposure would significantly increase use of family planning and reduce unmet need. Moreover women with media exposure were about four times as likely to use a method of family planning as women with no media exposure.

Likewise, the majority of currently married Ethiopian women want to control their fertility. According to the 2000 Ethiopia Demographic and Health Survey report, nearly one-third of Ethiopian women do not want to have any more children, a figure that rose from one-quarter in the 1990 National Family and Fertility Survey (NFFS). In the 1990 NFFS, unmet need for family planning to limit childbearing was less than 1 percent among currently married women, whereas this figure was 14 percent in the 2000 Ethiopia DHS survey. This means that there is an increasing demand for fertility control (CSA, 1993; CSA and ORC Macro, 2001).

Using the 1990 NFFS, Sahleyesus (1995) studied determinants of contraceptive non use and unmet need among married women in urban Ethiopia. The findings showed that the number of surviving children and ideal family size are the most important determinants of unmet need for family planning in urban Ethiopia.

CHAPTER THREE

DATA AND METHODOLOGY

3.1 SOURCE OF DATA

The data for this study were obtained from the publications of the Central Statistical Agency (CSA) on the 2005 Ethiopian Demographic and Health Survey (EDHS). The 2005 EDHS was the second national demographic and health survey conducted by CSA. The 2005 EDHS was conducted with the prime objective of generating health and demographic information on family planning, female circumcision fertility level and determinants, infant, child, adult and maternal mortality, child and maternal nutrition, malaria, women's empowerment, and knowledge of HIV/AIDS along with other household characteristics in the nine regions and two administrative regions both at rural and urban levels. The study used data a total of 14,070 women in the age group 15-49 years.

3.2 VARIABLES IN THE STUDY

The dependent variable is a dichotomous random variable "currently use a contraceptive method" (coded as 1) and "currently use no contraceptive method" (coded as 0). Factors that influence the use of contraceptive practice included in the study are: age of a woman, place of residence, religion, partners education level, woman's education, heard information about family planning (FP) on radio last month before the survey, frequency of listening to radio, visited by FP worker in last 12 months, woman currently working, region and wealth index.

Table 3.1 Description and coding of response and predictor variables

The Response variable

variable	Representation of variable	categories
Contraceptive use	Y	0= not using 1=using

Predictor variables

variable	Representation of variable	categories
1. age of a woman (age)	X_1	1=15-19 2=20-24 3=25-29 4=30-34 5=35-39 6=40-44 7=45-49
2. religion	X_2	1=Coptic orthodox 2=catholic 3=protestant 4=Muslim 5=traditional 6=others
3. educational attainment	X_3	0=no education 1=primary 2=secondary 3=higher
4. partners education level	X_4	0=no education

		1=primary 2=secondary 3=higher
5. place of residence	X_5	1=urban 2=rural
6. region	X_6	1=Tigray 2=Afar 3=Amhara 4=Oromiya 5=Somali 6=Ben-Gumuz 7=SNNP 8=Gambela 9=Hareri 10=Addis Ababa 11=Dire Dawa
7.wealth index	X_7	1=poor 2=middle 3=rich
8. frequency of listening to radio	X_8	0=not at all 1=less than once a week 2=at least once a week 3=almost every day
9. heard family planning (FP) on radio last month before the survey	X_9	0=no 1=yes
10. visited by FP worker last 12 month	X_{10}	0=no 1=yes

11. woman currently working	X_{11}	0=no 1=yes

3.3 THE LOGISTIC REGRESSION

Logistic regression is a statistical technique for predicting the probability of an event, given a set of predictor variables. The procedure is more sophisticated than the linear regression procedure. The binary logistic regression procedure empowers one to select the predictive model for dichotomous dependent variables. It describes the relationship between a dichotomous response variable and a set of explanatory variables. The explanatory variables may be continuous or discrete. The logistic model, as a non-linear regression model, is a special case of generalized linear model (McCullagh and Nelder, 1989) where the assumptions of normality and constant variance of residuals are not satisfied.

Binary response models are of major importance in the social sciences as well as in demography since many social phenomena are discrete or qualitative rather than continuous or quantitative in nature. Such binary discrete phenomena usually take the form of a dichotomous indicator or dummy variable. Many such analyses involve an outcome or dependent variable that is dichotomous and in such studies the logistic regression model has become the statistical model of choice. It is now common to find, in an article using logistic regression, a table of estimated coefficients, estimated odds ratios and associated confidence limits for the odds ratio (Pampel, 2000; Hosmer and Lemeshow, 2000).

Binary (or binomial) logistic regression is a form of regression which is used when the dependent variable is a dichotomous and the predictor variables are of any type. Multinomial logistic regression handles the case of dependent variables with more than two classes. When multiple classes of a multinomial dependent variable can be ranked, then ordinal logistic regression is preferred to multinomial logistic regression. Continuous variables are not used as dependent variables in logistic regression.

Logistic regression can be used to predict the probability of the outcome of a dependent variable on the basis of continuous and / or categorical independent variables and to determine the magnitude of the independent variables on the dependent variable; to rank the relative importance of independent variables; to assess interaction effects; and to understand the impact of covariate control variables. The impact of predictor variables is usually explained in terms of odds ratios.

Logistic regression utilizes the maximum likelihood estimation method after transforming the dependent variable in to a logit variable (the natural log of the odds of the dependent variable occurring or not).

Logistic regression has many analogies to OLS regression: logit coefficients correspond to b coefficients in the logistic regression equation, the standardized logit coefficients correspond to beta weights, and a pseudo R^2 statistic is available to summarize the strength of the relationship. Unlike OLS regression, however, logistic regression does not assume linearity of relationship between the independent variables and the dependent variable, does not require normally distributed errors, does not assume homoscedasticity, and in general has less stringent requirements. It does, however, require that the observations be independent and that the independent variables be linearly related to the logit of the dependent variable. The predictive success of the logistic regression can be assessed by looking at the classification table, showing correct and incorrect classifications of the dichotomous, ordinal, or polytomous dependent variable. Goodness-of-fit tests such as the likelihood ratio test are available as indicators of model appropriateness, as is the Wald statistic to test the significance of individual independent variables.

3.4 Assumptions of logistic regression

The validity of inferences drawn from modern statistical modeling techniques depends on the assumptions of the statistical model being satisfied. In order for our analysis to be valid, our model has to satisfy the assumptions of logistic regression such as:-

1. It does not need a linear relationship between the dependent and independent variables. Logistic regression can handle all sorts of relationships, because it applies a non-linear log transformation to the predicted odds ratio.

2. The error terms (the residuals) need to be binomially distributed.

3. The assumption of homoscedasticity is not necessary in logistic regression. Logistic regression can handle ordinal and nominal data as independent variables.

4. Logistic regression requires the dependent variable to be categorical (mostly binary). Reducing an ordinal or even metric variable to dichotomous level loses a lot of information, which makes the logistic regression inferior compared to ordinal regression in these cases.

5. Since logistic regression assumes that P(Y=1) is the probability of the event occurring, it is necessary that the dependent variable is coded accordingly. That is for the factor level 1 the dependent variable should represent the desired outcome.

6. The logistic regression model should be fitted correctly. Neither overfitting nor underfitting should occur. That is only the meaningful variables should be included, but also all meaningful variables should be included.

7. The error terms need to be independent. Logistic regression requires each observation to be independent. That is that the data-points should not be from any dependent samples design.

8. Logistic regression assumes linearity of independent variables and log odds. Whilst logistic regression does not require the dependent and independent variables to be related linearly, it requires that the independent variables are linearly related to the log odds. Otherwise the logistic regression underestimates the strength of the relationship and rejects the relationship easily, that is being not significant (not rejecting the null hypothesis) where it should be significant. A solution to this problem is the categorization of the independent variables. That is transforming metric variables to ordinal level and then including them in the logistic regression model.

9. Logistic regression requires quite large sample sizes. Because maximum likelihood estimates are less powerful than ordinary least squares (e.g., simple linear regression, multiple linear regression); whilst OLS needs 5 cases per independent variable in the analysis, ML needs at least 10 cases per independent variable, some statisticians recommend at least 30 cases for each parameter to be estimated.

3.5 Odds ratio

The odds of an event happening (e.g. the event that $Y = 1$) is defined as the ratio of the probability that the event will occur divided by the probability that the event will not occur. That is, the odds of the event E is given by

$$odds(E) = \frac{P(E)}{P(notE)} = \frac{P(E)}{1 - P(E)}$$

3.6 The Model

The dependent variable in logistic regression is usually dichotomous, that is, the dependent variable can take the value 1 with a probability of success π, or the value 0 with probability of failure 1-π. This type of variable is called a Bernoulli (or binary) variable.

As mentioned previously, the independent or predictor variables in logistic regression can take any form. The relationship between the predictor and response variables is not a linear function in logistic regression; instead, the logistic regression function, which is the logit transformation of π, is used. Consider a collection of p explanatory variables denoted by the vector X' = (X1, X2,…, Xp). Let the conditional probability that the outcome is present be denoted by P(Y = 1 | X) = π.

$$\pi = \frac{\exp(\beta_o + \beta_1\chi_1 + \ldots + \beta_p\chi_p)}{1 + \exp(\beta_o + \beta_1\chi_1 + \ldots + \beta_p\chi_p)}$$

Then the logit or log-odds of having Y=1 is modeled as a linear function of the explanatory variables as:

$$\ln\left(\frac{\pi}{1-\pi}\right) = \beta_o + \beta_1\chi_1 + ... + \beta_p\chi_p; 0 \le \pi \le 1$$

where β_0 is the constant of the equation and, $\beta_1,\ldots, \beta_p$ are the coefficients of the predictor variables. The above equation is known as the logistic function.

3.7 Method of estimation

The most common method used to estimate the unknown parameters in linear regression is the Ordinary Least Squares (OLS). Under usual assumptions, least square estimations have some desirable properties. But when the OLS method is applied to estimate a model with a dichotomous outcome the estimators no longer have these properties. In such a situation, the most commonly used method of estimating the parameters of a logistic regression model is the method of Maximum Likelihood (ML). In logistic regression, the likelihood equations are non-linear explicit function of unknown parameters. Therefore, we use a very effective and well known Newton-Raphson iterative method to solve the equations which is known as iteratively reweighted least squares algorithm.

In general, the sample likelihood function is defined as the joint probability function of the random variables. Specifically, suppose $(y_1, y_2,\ldots,y_n)$ are the n independent random observations corresponding to the random variables $(Y_1, Y_2,\ldots,Y_n)$. Since the Y_i is a Bernoulli random variable, the probability function of Y_i is $f_i(y_i) = \pi_i^{y_i} (1-\pi_i)^{1-y_i}$; y_i = 0 or 1; i = 1, 2, ..., n, since Y's are assumed to be independent, the joint probability function or likelihood function is given by:

$$g(y_1, y_2,..., y_n) = \prod_{i=1}^{n} \pi_i^{y_i} (1-\pi_i)^{1-y_i}$$

the log-likelihood function as:

$$L(\beta_o, \beta_1, \ldots \beta_p) = \sum_{i=1}^{n} y_i(\beta_o + \beta_1\chi_1 + \ldots + \beta_p\chi_p) - \sum_{i=1}^{n} \ln\{1 + \exp(\beta_o + \beta_1\chi_1 + \ldots + \beta_p\chi_p)\}$$

The most effective and well known Newton-Raphson iterative method can solve the equations.

3.8 Test of Overall Model Fit

3.8.1 R^2 for Logistic Regression

In logistic regression, there is no true R^2 value as there is in OLS regression. However, because deviance can be thought of as a measure of how poorly the model fits (i.e., lack of fit between observed and predicted values), an analogy can be made to sum of squares residual in ordinary least squares. The proportion of unaccounted for variance that is reduced by adding variables to the model is the same as the proportion of variance accounted for, or R^2.

$$R^2_{logistic} = \frac{-2LLnull - 2LLk}{-2LLnull}$$

where the null model is the logistic model with just the constant and the k model contains all the predictors in the model.

In SPSS, there are two modified versions of this basic idea, one developed by Cox and Snell and the other developed by Nagelkerke. The Cox and Snell R-square is computed as follows:

$$\text{Cox \& Snell Pseudo-}R^2 = 1 - \left[\frac{-2LLnull}{-2LLk}\right]^{\frac{2}{n}}$$

Because this R-squared value cannot reach 1.0, Nagelkerke modified it. The correction increases the Cox and Snell version to make 1.0 a possible value for R-squared (Hosmer and Lemeshow, 2000).

$$\text{Nagelkerke Pseudo-}R^2 = \frac{1-\left[\frac{-2LLnull}{-2LLk}\right]^{2/n}}{1-\left[-2LLnull\right]^{2/n}}$$

3.8.2 The Hosmer-Lemeshow Test

In order to find the overall goodness-of-fit, Hosmer and Lemeshow proposed grouping based on the values of the estimated probabilities.

Hosmer-Lemeshow goodness-of-fit test divides subjects in to deciles based on predicted probabilities and computes a chi-square from observed and expected frequencies. Using this grouping strategy, the Hosmer-Lemeshow goodness-of-fit statistic, $\hat{C}$ is obtained by calculating the Pearson chi-square statistic from the $g\times 2$ table of observed and estimated expected frequencies. A formula defining the calculation of $\hat{C}$ is as follows:

$$\hat{C} = \sum_{k=1}^{g} \frac{\left(o_k - n'_k \overline{\pi_k}\right)^2}{n'_k \overline{\pi_k}\left(1-\overline{\pi_k}\right)}$$

where, g denotes the number of groups, n'_k is the number of observations in the k^{th} group, o_k is the sum of the Y values for the k^{th} group and $\overline{\pi}_k$ is the average of the ordered $\overline{\pi}_k$ for the kth group. Hosmer and Lemeshow (1980) demonstrated that under the null hypothesis that the fitted logistic regression model is the correct model, the distribution of the statistic $\hat{C}$ is well approximated by the chi-square distribution with g-2 degrees of freedom. This test is more reliable and robust than the traditional chi-square test (Agresti, 2002).

3.8.3 The likelihood ratio test

The likelihood ratio (LR) test is performed by estimating two models and comparing the fit of one model to the fit of the other. Removing predictor variables from a model will almost always make the model fit less well (i.e., a model will have a lower log likelihood), but it is necessary to test whether the observed difference in model fit is statistically significant. The likelihood ratio test does this by comparing the log likelihoods of the two models, if this difference is statistically significant, then the less restrictive model (the one with more variables) is said to fit the data significantly better than the more restrictive model. If one has the log likelihoods from the models, the likelihood ratio statistic is fairly easy to calculate. The likelihood ratio test is performed to test the overall significance of all coefficients in the model on the basis of test statistic:

$$G^2 = [(-2\ln L_o)-(-2\ln L_1)]$$

where, L_0 is the likelihood of the null model and L_1 is the likelihood of the saturated model. The statistic G^2 plays the same role in logistic regression as the numerator of the partial F-test does in linear regression.

Under the global null hypothesis, H_0: $\beta_1 = \beta_2 = ... = \beta p = 0$ the statistic G^2 follows a chi-square distribution with p degrees of freedom and measures how well the independent variables affect the response variable.

3.9 Tests of a Single Predictor

3.9.1 The Wald test

The Wald test approximates the likelihood ratio test, but with the advantage that it only requires estimating one model. The Wald test works by testing the null hypothesis that a set of parameters is equal to some value. If the test fails to reject the null hypothesis, this suggests that removing the variables from the model will not substantially harm the fit of that model, since a predictor with a coefficient that is very small relative to its standard error is generally not doing much to help predict the dependent variable.

The Wald statistic is:

$$W = \left[\frac{\hat{\beta}}{SE\left(\hat{\beta}\right)} \right]^2$$

Under the null hypothesis H_0: $\beta_i = 0$, the square of W, W^2, is approximately distributed as chi-square with one degree of freedom.

3.9.2 The Lagrange multiplier or score test

As with the Wald test, the Lagrange multiplier test requires estimating only a single model. The difference is that with the Lagrange multiplier test, the model estimated does not include the parameter(s) of interest. The test statistic is calculated based on the slope of the likelihood function at the observed values of the variables in the model (predictor variables). This estimated slope or "score" is the reason the Lagrange multiplier test is sometimes called the score test. The scores are then used to estimate the improvement in model fit if additional variables were included in the model. Because it tests for improvement of model fit if variables that are currently omitted are added to the model, the Lagrange multiplier test is sometimes also referred to as a test for omitted variables.

If the MLE equals the hypothesized value, p_o, then p_o would maximize the likelihood and $U(p_o) = 0$. The score statistic measures how far from zero the score function is when evaluated at the null hypothesis. The test statistic is:

$$S = \frac{U(p_o)^2}{I(p_o)}$$

The statistic S is approximately distributed as chi-square with one degree of freedom.

The Likelihood Ratio, Wald and score test of the significance of a single predictor are said to be “asymptotically” equivalent, which means that their significance values will converge with larger N. With small samples, however, they are not likely to be equal and may sometimes lead to different statistical conclusions (i.e., significance). The likelihood ratio test for a single predictor is usually recommended by texts as the most powerful (although some authors have stated that neither the Wald nor the LR tests are superior). Wald tests are known to have low power (higher Type II errors) and can be biased when there is insufficient data (i.e., expected frequency is too low) for each category or value of X. However, very few researchers use the likelihood ratio test for tests of individual predictors. One reason may be that the statistical packages do not provide this test for each predictor, making hand computations and multiple analyses necessary. This is inconvenient, especially for larger models. If the analysis has a large N, researchers are likely to be less concerned about the differences (Agresti, 2002).

3.10 Logistic Regression Diagnostics

Regression diagnostics were developed to measure various ways in which a regression relation might derive largely from one or two observations.

3.10.1 Residuals Analysis

Residual analysis for logistic regression is more difficult than the linear regression models because the responses take on only the values 0 and 1. Thus the ith ordinary residual will assume one of the two values as:

$$\hat{\varepsilon}_i = \begin{cases} 1-\hat{\pi}_i, Y_i = 1 \\ -\hat{\pi}_i, Y_i = 0 \end{cases}$$

The ordinary residuals will not be normally distributed and, indeed their distribution under the assumption that the fitted model is correct is unknown. Plots of ordinary residuals against fitted values will generally be uninformative. In linear regression a key assumption is that the error variance does not depend on the conditional mean E (Y|X=x). However, in logistic regression, the errors follow a binomial distribution and, as a result, the error variance is a function of the conditional mean as $V(Y/X = x) = \pi(1-\pi)$. Hence, the ordinary residual can be made more comparable by dividing them by the estimated standard error of Yi which is known as Pearson residual denoted by pr_i and defined as:

$$pr_i = \frac{\hat{\varepsilon}}{\sqrt{\hat{\pi}_i\left(1-\hat{\pi}_i\right)}} = \frac{Y_i - \hat{\pi}_i}{\sqrt{\hat{\pi}_i\left(1-\hat{\pi}_i\right)}}$$

The Pearson residuals are directly related to the Pearson chi-square goodness-of-fit statistic. The square of Pearson residual measures the contribution of each binary response to the Pearson chi-square test statistic but the test statistic does not follow an approximate chi-square distribution for binary data without replicates. The Pearson residuals do not have unit variance since no allowance has been made for the inherent variation in the fitted value. A better procedure is to further standardize the ordinary residuals by their estimated standard deviation that is called studentized Pearson residuals. Then studentized Pearson residuals spri are defined as:

$$spr_i = \frac{Y_i - \hat{\pi}_i}{\sqrt{\hat{\pi}_i(1-\hat{\pi}_i)(1-h_{ii})}} = \frac{pr_i}{\sqrt{1-h_{ii}}}$$

where h_{ii} is the i^{th} diagonal element of the n×n estimated hat matrix H.

Studentized Pearson residuals are primarily helpful in identifying influential observations and those build in information about the influence of a case, whereas Pearson residuals do not. More influential cases with high leverages result in high studentized Pearson residuals. Studentized Pearson residuals approximately follow the standard normal distribution for large ($n \geq 30$) sample and it can be used as an approximate chi-square distribution (Rawlings, 1998).

Deviance residual is another type of residual. It measures the disagreement between any component of the log likelihood of the fitted model and the corresponding component of the log likelihood that would result if each point were fitted exactly. Since, the logistic regression uses the maximum likelihood principle; the goal in logistic regression is to minimize the sum of the deviance residuals. Deviance residuals can also be useful for identifying potential outliers or misspecified cases in the model. The deviance residual for the i^{th} case is defined as the signed square root of the contribution of that case to the sum for the model deviance as:

$$dr_i = sign\left(Y_i - \hat{\pi}_i\right)\left\{-2\left[Y_i \ln\left(\hat{\pi}_i\right) + (1-Y_i)\ln\left(1-\hat{\pi}\right)\right]\right\}^{1/2}$$

The standardized and deviance residuals are the most commonly used statistic in identifying points for which the model fits poorly. Observations with absolute standardized and deviance residual values in excess of 3 may indicate lack of fit (Rawlings, 1998).

Leverage Values

Detecting outliers is common practice and it is important to distinguish between two types of outliers. Outliers in the response variable represent model failure. Such observations are called outliers. Outliers with respect to the predictors are called leverage points. They can affect the regression model, too. However, they may almost uniquely determine regression coefficients. They may also cause the standard errors of regression coefficients to be much smaller than they would be if the observation were excluded.

Leverage is a term used in connection with regression analysis and, in particular, in analyses aimed at identifying those observations which have a large effect on the outcome of fitting regression models. Leverage points are those observations, if any, made at extreme or outlying values of the independent variables such that the lack of neighboring observations means that the fitted regression model will pass close to that particular observation. Leverages values are given by:

$$H = \hat{W}^{1/2} X\left(X'\hat{W} X \right)^{-1} X'\hat{W}^{1/2}$$

where h_{ii} is the i^{th} diagonal element of the nxn estimated hat matrix H, whereby in logistic regression it is called hat diagonal or Pregibon leverage and measures the leverage of an observation. More clearly leverage is a measure of the importance of an observation to the fit of the model. Here, $\hat{W}$ is the nxn diagonal matrix with elements $\hat{\pi}_i\left(1-\hat{\pi}_i\right)$, X is the nx (k+1) design matrix.

3.10.2 Influential Statistics

Cook's Distance

Cook's D (Cook, 1977; Cook and Weisberg, 1982) is designed to measure the shift in $\hat{\beta}$ when a particular observation is omitted. It is a combined measure of the impact of that observation on all regression coefficients.

Cook's D_i statistic is defined as:

$$D_i = \frac{\left(\hat{\beta}_i - \hat{\beta}_{(i)}\right)'(X'X)\left(\hat{\beta}_i - \hat{\beta}_{(i)}\right)}{ps^2}$$

Computationally, D_i is more easily obtained as

$$D_i = \frac{r_i^2}{p}\left(\frac{h_{ii}}{1-h_{ii}}\right)$$

where r_i is the studentized residual and h_{ii} is the i^{th} diagonal element of H computed from the full regression and p is the number of unknown parameters. Notice that D_i is large if the standardized residual is large and if the data point is far from the cancroids of the X-space that is, if v_{ii} is large.

The Cook's distance statistic assesses the influence of individual cases and is a measure of the change in the regression coefficient if an observation is deleted from the model.

Cook's distance considers the influence of the i^{th} value on all n fitted values and not on the fitted value of the i^{th} observation. It yields the shift in the estimated parameter from fitting a regression model when a particular observation is omitted. All distances should be roughly equal; if not, then there is reason to believe that the respective case(s) biased the estimation of the regression coefficients. Relatively large Cook statistics (or Cook's distance) indicates influential observations. This may be due to a high leverage, a large residual or their combination. There are different opinions regarding what cut-off values to use for spotting outliers. A simple operational guideline of $D_i > 1$ has been suggested (Rawlings, 1998).

DFBETAS: Cook's distance reveals the impact of the i^{th} observation on the entire vector of the estimated regression coefficients. The influential observations for the individual regression coefficients are identified by DFBETASj(i), j = 0, 1, 2, . . . , p, where each DFBETASj(i) is the standardized change in $\hat{\beta}_j$ when the i^{th} observation is deleted from the analysis. Thus,

$$DFBETAS_{j(i)} = \frac{\hat{\beta}_j - \hat{\beta}_{j(i)}}{s_i \sqrt{c_{jj}}}$$

where c_{jj} is the $(j + 1)^{st}$ diagonal element from $(X'X)^{-1}$. DFBETASj(i) measures the change in $\hat{\beta}_j$ in multiples of its standard error. Although this looks like a t-statistic, it should not be interpreted as a test of significance. Values of DFBETASj(i) greater than 2 would certainly indicate a major, but very unlikely, impact from a single point. The cutoff point of $2/\sqrt{n}$ is suggested by Belsley et al (1980) as the point that will tend to highlight the same proportion of influential points across data sets.

CHAPTER FOUR

STATISTICAL DATA ANALYSIS

4.1 Introduction

The purpose of this chapter is to analyze the effect of different socio-economic and demographic determinants of contraceptive usage of women in Ethiopia using the data from the 2005 Ethiopian Demographic and Health Survey (EDHS). The response variable considered in this study is binary assuming two outcomes (0 = not using, 1 = using), which are indicators of contraceptive usage status of Ethiopian women. Descriptive and binary logistic regression methods are used to measure the effects of the determinants of contraception. The descriptive part provides percentages of contraceptive usage status of women. The binary logistic analysis is employed to assess the determinants of contraceptive usage and to predict the odds of contraceptive usage in Ethiopia. The data are analyzed using the Statistical Package for Social Sciences (SPSS) version 13.

4.2 Summary of descriptive statistics

Table 4.1 Descriptive statistics of contraceptive usage status of women.

		currently use contraceptive method					
		using		not using		Total	
		Count	Row N %	Count	Row N %	Count	Row N %
educational attainment	no education	664	9.0%	6724	91.0%	7388	100.0%
	primary	371	23.4%	1215	76.6%	1586	100.0%
	secondary	458	46.1%	535	53.9%	993	100.0%
	higher	80	47.6%	88	52.4%	168	100.0%
wealth index	poor	165	4.1%	3882	95.9%	4047	100.0%
	middle	180	11.1%	1447	88.9%	1627	100.0%
	rich	1228	27.5%	3233	72.5%	4461	100.0%

partners education level	no education	444	7.5%	5489	92.5%	5933	100.0%
	primary	435	19.1%	1847	80.9%	2282	100.0%
	secondary	521	33.5%	1033	66.5%	1554	100.0%
	higher	173	47.3%	193	52.7%	366	100.0%
Age 5-year groups	15-19	88	10.2%	771	89.8%	859	100.0%
	20-24	310	18.2%	1392	81.8%	1702	100.0%
	25-29	419	19.3%	1753	80.7%	2172	100.0%
	30-34	270	16.5%	1368	83.5%	1638	100.0%
	35-39	277	17.8%	1278	82.2%	1555	100.0%
	40-44	138	12.0%	1010	88.0%	1148	100.0%
	45-49	71	6.7%	990	93.3%	1061	100.0%
Frequency of listening to radio	Not at all	469	7.8%	5564	92.2%	6033	100.0%
	Less than once a week	554	22.2%	1941	77.8%	2495	100.0%
	At least once a week	66	22.8%	223	77.2%	289	100.0%
	Almost every day	484	36.7%	834	63.3%	1318	100.0%
Region	Tigray	128	13.2%	841	86.8%	969	100.0%
	Afar	33	4.8%	652	95.2%	685	100.0%
	Amhara	214	13.3%	1394	86.7%	1608	100.0%
	Oromiya	206	12.6%	1432	87.4%	1638	100.0%
	Somali	8	1.5%	539	98.5%	547	100.0%
	Ben-Gumz	87	12.3%	619	87.7%	706	100.0%
	SNNP	179	12.0%	1308	88.0%	1487	100.0%
	Gambela	93	15.3%	515	84.7%	608	100.0%
	Harari	156	27.6%	410	72.4%	566	100.0%
	Addis Abeba	315	40.1%	471	59.9%	786	100.0%
	Dire Dawa	154	28.8%	381	71.2%	535	100.0%
Religion	Coptic Orthodox	1005	21.6%	3649	78.4%	4654	100.0%
	Catholic	16	17.6%	75	82.4%	91	100.0%
	Protestant	196	12.3%	1396	87.7%	1592	100.0%
	Moslem	347	9.7%	3213	90.3%	3560	100.0%
	Traditional	6	4.2%	137	95.8%	143	100.0%
	Other	3	3.2%	92	96.8%	95	100.0%
Type of place of residence	Urban	853	36.5%	1482	63.5%	2335	100.0%
	Rural	720	9.2%	7080	90.8%	7800	100.0%
Heard FP on radio	No	684	9.4%	6563	90.6%	7247	100.0%
	Yes	889	30.8%	1999	69.2%	2888	100.0%

last months							
Visited by FP worker last 12m	No	1389	14.8%	8021	85.2%	9410	100.0%
	Yes	184	25.4%	541	74.6%	725	100.0%
Respondent currently working	No	1125	15.5%	6120	84.5%	7245	100.0%
	Yes	448	15.5%	2442	84.5%	2890	100.0%

The above table reveals that currently contraceptive usage differs by women's educational attainment. For instance, 91% of no educated women are not using contraceptive methods and the remaining 9% are using contraceptive methods. On the other hand women who have higher educational attainment are better on contraceptive usage (that is 47.6% of them are using and 52.4% of them are not using contraceptive methods).

Wealth index also contribute its own effect on the usage of contraceptive methods. Around 4.1% of poor, 11.1% of middle and 27.5% of rich women are currently using contraceptive methods. This indicates that prevalence rate of contraceptive usage increases as households' economic status increases.

Results on respondent's partner's educational level show that 47.3%, 33.5%, 19.15% and 7.5% of women whose partners have higher education, secondary, primary and no education, respectively are currently using contraceptive methods. The result also shows that husband's education is a positive determinant of current contraceptive use.

The result shows that women who live in different regions also have different status on the usage of contraceptive methods. The highest proportion of contraceptive usage is observed in Addis Ababa (40.1%) followed by Dire Dawa (28.8%) and the least one is observed in Afar region (4.8%) followed by Somali region (1.5%).

The age of women is another important factor with regard to usage of contraceptive methods. The highest percentage of contraceptive usage is observed in the age group 25-29 (19.3%) and lowest percentage of contraceptive usage is observed in the age group 45-49 (6.7%).

The exposure of women to mass media like frequency of listening to radio is another variable to affect usage of contraceptive methods. For example, the highest proportion (36.7%) of women who are using contraceptive methods listen radio almost every day. On the other hand, the lowest rate of contraceptive usage (7.8%) has been observed in the category of women who are not listening radio at all.

With regards to religion, contraceptive usage of women is highest for coptic orthodox (21.6%) followed by 17.6% of catholics. The lowest contraceptive usage (3.2%) of women was recorded for followers of other religions.

The proportion of contraceptive usage differs by place of residence. The contraceptive usage status of women (current users) who reside in urban areas is 36.5% the remaining 63.5% are non users. Among rural women 9.2% are currently contraceptive users and 90.8% are non users. The prevalence rate of contraceptive usage is higher among women who reside in urban areas (36.5%) as compared to rural area (9.2%).

It is clear that exposure of women to family planning message on radio may enhance contraceptive usage. Among women who did not hear family planning messages on the radio in last month before the survey, only 9.4% were using contraceptive method and the remaining 90.6% of them were not using contraceptive methods at the time of the survey. But about 30.8% of women who heard family planning on the radio in last month before survey were using contraceptive method while the remaining 69.2% of them were not contraceptive users at the time of the survey. The prevalence rate of contraceptive usage was higher among women who have heard family planning on radio in the last month before the survey.

Women visited by family planning workers have more perception on the usage of contraceptive methods. About 25.4% of women visited by family planning workers in the last 12 month before the survey were using contraceptive method; while only 14.8% of women not visited by family planning workers in the last 12 month before the survey were using contraceptive method at the time of the survey. The prevalence rate of contraceptive usage was higher among women who were visited by family planning workers in the last 12 month before the survey. About 15.5% of women that are working were using contraceptive method and the remaining 84.5% were not using contraceptive method.

4.3 Analysis of binary logistic regression

Table 4.2 Case Processing Summary

Unweighted Cases(a)		N	Percent
Selected Cases	Included in Analysis	10135	100.0
	Missing Cases	0	.0
	Total	10135	100.0
Unselected Cases		0	.0
Total		10135	100.0

a If weight is in effect, see classification table for the total number of cases.

Table 4.3 Dependent Variable Encoding

Original Value	Internal Value
not using	0
using	1

Block 0: Beginning Block

Table 4.4 classification table

Classification Table[a,b]

Observed			Predicted: currently use contraceptive method: not using	Predicted: currently use contraceptive method: using	Predicted: Percentage Correct
Step 0	currently use contraceptive method	not using	8562	0	100.0
		using	1573	0	.0
	Overall Percentage				84.5

a. Constant is included in the model.

b. The cut value is .500

By default, SPSS logistic regression is run in two steps. The first step, called Step 0, includes no predictors and just the intercept.

Observed - This indicates the number of 0's and 1's that are observed in the dependent variable (using contraceptive method).

Predicted - In this null model, SPSS predicted that all cases are 0 on the dependent variable.

Overall Percentage - This gives the percent of cases for which the dependent variables were correctly predicted for the null model which is 8562/10135 = 84.5%.

Table 4.5 Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	-1.694	.027	3814.925	1	.000	.184

In the model equation we see that the intercept-only model or null model is ln(odds) = -1.694. If we exponentiate both sides of this equation we find that our predicted odds [Exp(B)] = 0.184. That is, the predicted odd of using contraceptive method is 0.184. Since 1573 of our subjects are using contraceptive method and 8562 are not using contraceptive method, our observed odds are 1573 / 8562 = 0.184.

Table 4.6 Variables not in the Equation

			Score	df	Sig.
Step 0	Variables	education	1156.708	3	.000
		education(1)	887.260	1	.000
		education(2)	88.857	1	.000
		education(3)	786.296	1	.000
		wealth	919.347	2	.000
		wealth(1)	672.875	1	.000
		wealth(2)	29.366	1	.000
		partner.edu	979.714	3	.000
		partner.edu(1)	704.958	1	.000
		partner.edu(2)	28.176	1	.000
		partner.edu(3)	453.848	1	.000
		age	132.395	6	.000
		age(1)	19.926	1	.000
		age(2)	11.317	1	.001
		age(3)	29.974	1	.000
		age(4)	1.382	1	.240
		age(5)	7.366	1	.007

age(6)	12.093	1	.001
lis.radio	824.792	3	.000
lis.radio(1)	682.218	1	.000
lis.radio(2)	112.774	1	.000
lis.radio(3)	12.147	1	.000
region	678.214	10	.000
region(1)	4.364	1	.037
region(2)	64.185	1	.000
region(3)	7.132	1	.008
region(4)	12.916	1	.000
region(5)	87.151	1	.000
region(6)	5.917	1	.015
region(7)	16.122	1	.000
region(8)	.025	1	.875
region(9)	66.293	1	.000
region(10)	391.864	1	.000
religion	259.304	5	.000
religion(1)	242.138	1	.000
religion(2)	.298	1	.585
religion(3)	14.833	1	.000
religion(4)	139.498	1	.000
religion(5)	14.187	1	.000
residence(1)	1021.493	1	.000
FP.radio(1)	717.519	1	.000
FP.visit(1)	57.885	1	.000
working(1)	.001	1	.974
Overall Statistic	1797.381	36	.000

The score test is used to estimate the improvement in model fit if additional variables were included in the model. The test statistic is the expected change in the chi-squared statistic for the model if a variable or set of variables is added to the model. Because it tests for improvement of model fit if variables that are currently omitted are added to the model, the score test is sometimes also referred to as a test for omitted variables.

Looking at the p-values (located in the column labeled "Sig."), we can see that each of the predictors would be statistically significant except for working that is including all predictors except working in the model would create a statistically significant improvement in model fit.

From the result of overall statistic we can conclude that including all predictors in the model would create a statistically significant improvement in model fit.

Block 1: Method = Enter

Table 4.7 Omnibus test of model coefficients

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	1758.460	36	.000
	Block	1758.460	36	.000
	Model	1758.460	36	.000

Consider the model which includes all predictors. Omnibus Tests of Model Coefficients gives us a Chi-Square of 1758.460 which is significant at 0.01. This is a test of the null hypothesis that adding the predictors to the model has not significantly increased our ability to predict contraceptive use made by our subjects. Since our omnibus test is significant we can conclude that adding the predictors to the model has significantly increased our ability to predict contraceptive use made by our subjects.

Table 4.8 Model summary

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	6990.721[a]	.159	.275

a. Estimation terminated at iteration number 7 because parameter estimates changed by less than .001.

The most common assessment of overall model fit in logistic regression is the likelihood ratio test, which is simply the chi-square difference between the null model (i.e., with the constant only) and the model containing the predictors. Under Model Summary we see that the -2 Log Likelihood statistic is 6990.721. This statistic measures how poorly the model predicts the use of contraceptive method, the smaller the statistic the better the model. SPSS does not give us this statistic for the model that had only the intercept; we know it to be 8749.181 (6990.721+ 1758.460). Adding the predictors reduced the -2 Log Likelihood statistic by 8749.181 – 6990.721 = 1758.460, which is the $\chi 2$ statistic for omnibus test. The value of Cox & Snell R^2 and Nagelkerke R^2 are good enough.

Table 4.9 Hosmer-Lemeshow test

Hosmer-Lemeshow Test

Step	Chi-square	df	Sig.
1	13.842	8	.086

Contingency Table for Hosmer-Lemeshow Test

		currently use contraceptive method = not using		currently use contraceptive method = using		
		Observed	Expected	Observed	Expected	Total
Step 1	1	1012	1008.743	8	11.257	1020
	2	993	986.988	21	27.012	1014
	3	980	973.951	36	42.049	1016
	4	947	958.762	68	56.238	1015
	5	925	935.353	90	79.647	1015
	6	893	903.210	121	110.790	1014
	7	859	859.784	155	154.216	1014
	8	798	792.977	216	221.023	1014
	9	699	668.512	316	346.488	1015
	10	456	473.721	542	524.279	998

Another method of assessment for overall goodness of fit is by using the Hosmer-Lemshow test. The Hosmer-Lemeshow test is performed by dividing the predicted probabilities into deciles (10 groups based on percentile ranks) and then computing a Pearson chi-square that compares the predicted to the observed frequencies (in a 10x2 table). A nonsignificant chi-square indicates a good fit to the data and, therefore, good overall model fit. Since the p-value is 0.086 which is insignificant therefore our fitted logistic regression model is good fit.

Table 4.10 Classification table for block one

Classification Table[a]

	Observed		Predicted: currently use contraceptive method: not using	Predicted: currently use contraceptive method: using	Predicted: Percentage Correct
Step 1	currently use contraceptive method	not using	8306	256	97.0
		using	1228	345	21.9
	Overall Percentage				85.4

a. The cut value is .500

Observed - This indicates the number of 0's and 1's that are observed in the dependent variable (currently use contraceptive method).

Predicted - These are the predicted values of the dependent variable based on the full logistic regression model. Table 4.10 shows how many cases are correctly predicted (8306 cases are observed to be 0 and are correctly predicted to be 0; 345 cases are observed to be 1 and are correctly predicted to be 1), and how many cases are not correctly predicted (256 cases are observed to be 0 but are predicted to be 1; 1228 cases are observed to be 1 but are predicted to be 0).

Overall Percentage - This gives the overall percent of cases that are correctly predicted by the full model. Overall our predictions were correct 8651 out of 10135 times, for an overall success rate of 85.4%. As we can see, this percentage has increased from 84.5 (see page 44, Table 4.4) for the null model to 85.4 for the full model.

We could focus on error rates in classification. A false positive would be predicting that the event would occur when, in fact, it did not. Our decision rule predicted the use of contraceptive methods 601 times. That prediction was wrong 256 times, for a false positive rate of 256 / 601 = 42.6%. A false negative would be predicting that the event would not occur when, in fact, it did occur.

Our decision rule predicted that not using contraceptive methods are 9534 times. That prediction was wrong 1228 times, for a false negative rate of 1228 / 9534 = 12.88%.

Table 4.11 Variables in the Equation

Result of the binary logistic regression model

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1(a)	education			28.870	3	.000	
	education(1)	-.601	.206	8.526	1	.004	.548
	education(2)	-.326	.201	2.617	1	.106	.722
	education(3)	-.023	.189	.015	1	.904	.977
	wealth			101.397	2	.000	
	wealth(1)	-1.067	.106	100.919	1	.000	.344
	wealth(2)	-.309	.101	9.381	1	.002	.734
	partner.edu			29.893	3	.000	
	partner.edu(1)	-.574	.159	12.986	1	.000	.563
	partner.edu(2)	-.148	.153	.942	1	.332	.862
	partner.edu(3)	-.206	.139	2.194	1	.139	.814
	age			100.898	6	.000	
	age(1)	.644	.180	12.755	1	.000	1.905
	age(2)	1.105	.151	53.887	1	.000	3.019
	age(3)	1.245	.146	72.650	1	.000	3.474
	age(4)	1.066	.152	49.139	1	.000	2.905
	age(5)	1.174	.150	60.899	1	.000	3.236
	age(6)	.662	.163	16.433	1	.000	1.939
	lis.radio			19.348	3	.000	
	lis.radio(1)	-.399	.104	14.687	1	.000	.671

lis.radio(2)	-.060	.086	.489	1	.484	.942
lis.radio(3)	-.209	.164	1.612	1	.204	.812
region			45.425	10	.000	
region(1)	-.060	.166	.130	1	.718	.942
region(2)	-.692	.222	9.695	1	.002	.501
region(3)	.023	.150	.024	1	.877	1.023
region(4)	-.137	.144	.907	1	.341	.872
region(5)	-1.830	.382	22.977	1	.000	.160
region(6)	-.019	.172	.012	1	.912	.981
region(7)	-.170	.157	1.178	1	.278	.844
region(8)	.268	.177	2.302	1	.129	1.307
region(9)	-.100	.150	.441	1	.507	.905
region(10)	.054	.135	.159	1	.690	1.055
religion			25.274	5	.000	
religion(1)	1.210	.606	3.982	1	.046	3.352
religion(2)	1.231	.673	3.345	1	.067	3.425
religion(3)	.765	.609	1.580	1	.209	2.149
religion(4)	.979	.607	2.597	1	.107	2.662
religion(5)	.410	.738	.308	1	.579	1.506
residence(1)	.453	.098	21.324	1	.000	1.573
FP.radio(1)	-.240	.080	9.010	1	.003	.787
FP.visit(1)	-.527	.102	26.770	1	.000	.590
working(1)	.009	.068	.017	1	.895	1.009
Constant	-1.854	.667	7.726	1	.005	.157

a Variable(s) entered on step 1: education, wealth, partner.edu, age, lis.radio, region, religion, residence, FP.radio, FP.visit, working.

The result of the binary logistic regression model is presented table 4.11. Currently use of contraceptive was assigned a value of 1 if the respondents reported use and 0 otherwise. The reference category of each dichotomously measured independent variable has a value of one and the values for other categories are compared to that of the reference category. A value less than one implies that individuals in that category have a lower probability of current use of contraceptive methods than individuals in the reference category.

The Wald Chi-Square statistic, which tests the unique contribution of each predictor, holding the other predictors constant, that is, eliminating any overlap between predictors. Each predictor (except currently working) must meet the conventional .05 standard for statistical significance.

- -0.601 is the decrease in log odds for no education; the odds ratio $e^{-.601}$ = 0.548 means that the odds of using contraceptive methods has decreased by a factor of 0.548 for women with no education compared to those with higher education controlling for other variables in the model.
- -1.067 is the decrease in log odds for poor; the odds ratio $e^{-1.067}$ =0 .344 means that the odds of using contraceptive methods has decreased by a factor of 0.344 for poor women compared to rich women controlling for other variables in the model.
- -0.309 is the decrease in log odds for middle; the odds ratio $e^{-.309}$ = 0.734 means that the odds of using contraceptive methods has decreased by a factor of 0.734 for middle income women compared to rich women controlling for other variables in the model.
- -0.574 is the decrease in log odds for no partner education; the odds ratio $e^{-.574}$ = 0.563 means that the odds of using contraceptive methods has decreased by a factor of 0.563 for women whose partner has no education

compared to those whose partner has higher education controlling for other variables in the model.

- 0.644 is the increase in log odds of a better outcome for age group 15-19; the odds ratio $e^{.644} = 1.905$ indicates that women in the age group 15-19 are 90.5% more likely to use contraceptive methods compared to women in the age group 45-49 controlling for other variables in the model.
- 1.105 is the increase in log odds of a better outcome for age group 20-24; the odds ratio $e^{1.105} = 3.019$ indicates that women in the age group 20-24 are 3.019 times more likely to use contraceptive methods compared to women in the age group 45-49 controlling for other variables in the model.
- -0.399 is the decrease in log odds for not at all; the odds ratio $e^{-.399} = 0.671$ means that the odds of using contraceptive methods has decreased by a factor of 0.671 for women who are not listening to the radio compared to those listening almost every day controlling for other variables in the model.
- -0.692 is the decrease in log odds for Amhara; the odds ratio $e^{-.692} = 0.501$ means that the odds of using contraceptive methods has decreased by a factor of 0.501 for women who are living in Amhara region compared to those in Dire Dawa controlling for other variables in the model.
- 1.210 is the increase in log odds of a better outcome for followers of Coptic orthodox; the odds ratio $e^{1.210} = 3.352$ indicates that orthodox women are 3.352 times more likely to use contraceptive methods compared to others controlling for other variables in the model.
- 0.453 is the increase in log odds of a better outcome for urban; the odds ratio $e^{.453} = 1.573$ indicates that women in urban area are 57.3% more likely to use contraceptive methods compared to women in rural area controlling for other variables in the model.
- -0.240 is the decrease in log odds for not heard FP on radio last month; the odds ratio $e^{-.240} = 0.787$ means that the odds of using contraceptive

methods has decreased by a factor of 0.787 for women that have not heard FP on radio last month compared to those who have heard FP on radio last month controlling for other variables in the model.

- -0.527 is the decrease in log odds for not visited by FP worker; the odds ratio $e^{-.527} = 0.590$ means that the odds of using contraceptive methods has decreased by a factor of 0.590 for women who are not visited by FP worker compared to those visited by FP worker controlling for other variables in the model.

4.4 Diagnostic checking

Detection of outliers and influential cases and corresponding treatment is a very crucial task of any modeling exercise. A failure to detect outliers and hence influential cases can have severe distortion on the validity of the inferences drawn from such modeling exercise. It would be reasonable to use diagnostics to check if the model is adequate or not. The main focus here will be to detect outliers and influential cases that have a substantial impact on the fitted logistic regression model through appropriate graphical methods.

The diagnostic test results for detection of outliers and influential cases are included in the Appendix. A check of the standardized and deviance residuals reveals that all have values of less than absolute value of 3 indicating the absence of outliers in the model. In addition, there are no large values of Cook's distance (D_i<1) which means that there are no influential cases having an effect on the model and there are no high values of DFBETAS (all values less than 0.02) which means that there are no influential observations for the individual regression coefficients. Therefore, we can accept that the model as adequate.

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 Discussion and Conclusion

High fertility rates could be one of the major deterrents to sustained economic growth. The ill-effects of high population growth combined with stagnant income can result in growing income inequalities, lack of economic opportunities, high level of unemployment and where productivity level is low, food production cannot keep up with population growth, which leads to food insecurity. Problems posed by high fertility rates and population growth have sparked studies of the factors determining contraceptive usage since contraceptive is used for birth control. Understanding the factors that influence contraceptive use is critical to the efforts of programmes to increase prevalence. Much unmet need for family planning persists, even in settings where knowledge of contraceptive methods is high (Ayoub, 2004).

The findings in chapter four show that female education is a key determinant of contraceptive use. The result shows that women's educational attainment is a significant variable. Better educated women are assumed to be more willing to engage in innovative behavior than are less educated women, and better educated women have more knowledge of contraceptive methods or of how to acquire them than are less educated women because of their literacy, greater familiarity with modern institutions, and greater likelihood of rejecting a fatalistic attitude towards life. Education exposes women to information, empowers women, makes them more likely to be employed outside their home environment, and makes them more aware of their own health and the health of their children. Similarly, educated women are more likely to postpone marriage, have smaller family size, and use contraception than are uneducated women.

This supports the study done by Bertrand et al. (1993) who found that education affects the distribution of authority within households, whereby women may increase their authority with husbands, and affect fertility and use of family planning. The results are consistent with previous studies (Ainsworth et al. (1996), Martin and Juarez (1995)). These studies found that increasing women education improves their contraceptive usage.

The results of descriptive statistics and logistic regression analysis depicted that women's partner schooling significantly impacts the probability of using contraceptive methods. The use of contraceptive methods increases with the increase of partner's educational level. The results also confirm that partner's education increases receptivity of awareness and contraceptive use to control fertility. That is more educated husbands of women do indeed promote the use of contraception.

The results of our study also show that there is difference in women's contraceptive usage status among rural and urban dwellers. Urbanization significantly impacts contraceptive usage. That is, an urban-based woman is more likely to use contraceptive than the rural-based woman. The reason could be that women who live in rural areas tend to marry at a younger age than do those in urban areas. This also suggests that urban women may be more likely to use contraceptive (especially modern contraceptive methods) than rural women because of greater access to modern methods and medical care as well as other social amenities in urban areas. This supports the study by Bertrand et al. (1993) who found that modern contraceptive use is higher in urban than in the rural areas. Our results are also similar to that by Ainsworth et al. (1996), who determined that urban women have lower fertility than rural women.

The results of our study revealed that wealth index is an important variable which significantly affects the use of contraceptive methods. According to the findings of this study, women with low household economic status are at a lower level of contraceptive usage as compared to women residing in medium and rich household economic status. This shows that as the household economic status of women increases their contraceptive usage also increases. The reason could be that poor women may perceive children as a source of income, thus motivating them to have more children (Karki (1982)). The finding is also consistent with Hamill et al., (1990) who hypothesized that the wealth of the household may also be important because of its correlation with education and since wealth may have effects on desired family size and contraceptive use effectiveness. Another reason could be that the poorest people have less access to education and family planning methods.

The results of this study have indicated that age of a woman is an important variable which is found to be a determinant of contraceptive usage. The highest proportion of contraceptive usage is observed in the age group 25-29, this is due to the fact that the age group of surveyed women is 15-49, which indicates that most of these women's were in their childbearing age group. On the other hand, the lowest proportion of contraceptive usage in the age group 45-49. The results showed that women in the adolescent reproductive age group are better in contraception usage as compared to women in the oldest age group this is explained by the fact that adolescent women are at high risk of unintended pregnancy.

The results of this study revealed that there are significant regional differences in the usage of contraceptive methods. From the result it is observed that women residing in Addis Ababa and Dire Dawa are using contraceptive methods highly compared to other regions, and the low level of contraceptive usage is observed in Somali and Afar region. The lowest level of contraceptive usage in these regions could be due to non availability of health facility, health and family planning workers and also since they are rural populated areas and moving from one place to the other (pastoralists) it is hard to address them.

Throughout the world, mass media have influenced knowledge, attitudes, and behavior regarding the use of contraception. Exposure to mass media messages (frequency of listening to radio) is statistically significant in its relationship to the use of contraceptive methods. This study also found that mass media exposure (listening to radio) has an important effect on contraceptive usage. Those women who were exposed to radio had fewer children than those who were not exposed. It could be because radio programs and the values they disseminate (spread) are transmitted directly into the home; they have the potential to directly affect every member of the household, even those with little or no schooling. The role of mass media in changing both patterns of contraceptive use and notions of ideal family size could be another reason for low fertility among those exposed to mass media. A final important strategy to promote greater contraceptive use is to improve frequency of listening to radio. The finding is also consistent with the studies done by Dunn (2001) that hypothesized reaching people by effective mass media popularizing their contraceptive usage and family planning program.

Another interesting finding of this study was that women who heard family planning program on radio one month before the survey have improved the level of use of contraceptive methods. Reaching people with information about family planning program through radio in the last month can create awareness about family planning and promote information about contraceptive. The result confirmed that women who had no access to family planning lessons through radio are likely to dropout from contraceptive use as compared to those who did have access. Promoting family planning on radio about family planning program can be an important means of raising awareness, improving knowledge and stimulating use of modern contraceptive methods.

The results of the study have also depicted that women who were visited by family planning worker in the last 12 months before the survey are better in the use of contraception methods. Women who are visited by family planning workers in the last 12 month have a better chance of satisfying their demand for contraceptive usage. Therefore visiting women by family planning workers increased their prevalence rate of contraception usage and family planning program.

Religion appears to be an important determinant of current contraceptive use. This study found that the proportion of contraceptive usage for Muslim women ,women who are followers of traditional religion and those following religions other than Coptic orthodox, protestant, Muslim, catholic and traditional is low. On the other hand, high prevalence of contraceptive usage has been observed for Coptic orthodox and catholic women. Religions differ in regard to their beliefs concerning marriage, reproductive behavior, and contraception. It could be explained that misperception of religious leaders about modern contraceptive methods on birth control. This finding is consistent with the results of the study by Karki (1982).

5.2 Recommendation

- This study suggests that investment in women’s education should be a practical priority. Investment in primary education is necessary, but contraception models show that the impact (magnitude) of education increases with education level. Also, husband’s education has a great impact on women’s contraceptive usage. Therefore, the Ethiopian government should also invest heavily on women and their partner schooling beyond primary school. Investment in females’ and men education in secondary and higher education will foster economic growth and also promotes smaller families, increase modern contraceptive use, and improve child health.

- More family planning workers should be trained to give family planning services especially in remote areas. If adequate numbers of family planning workers are trained, the problem of access will be reduced very much.

- The study suggests that family planning workers provide counseling on prevention of unintended pregnancy and contraceptive options to all sexually active women who do not want to become pregnant or who do not want to have a child.

- Action should be taken to improve mass media messages through the radio and increasing the awareness about modern contraceptive methods should be given special attention. Family planning programmes on radio should encourage a woman to discuss family planning methods with her partner to reduce high fertility rate in Ethiopia.

- Awareness should be created about contraceptive usage to women in rural areas by increasing health facilities and family planning workers.

- Further study is required to assess the quality of family planning services in Ethiopia.

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Appendix

Categorical Variables Coding

		Frequency	Parameter coding									
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Region	Tigray	969	1.00	.000	.000	.000	.000	.000	.000	.000	.000	.000
	Afar	685	.000	1.000	.000	.000	.000	.000	.000	.000	.000	.000
	Amhara	1608	.000	.000	1.000	.000	.000	.000	.000	.000	.000	.000
	Oromiya	1638	.000	.000	.000	1.00	.000	.000	.000	.000	.000	.000
	Somali	547	.000	.000	.000	.000	1.00	.000	.000	.000	.000	.000
	Ben-Gumz	706	.000	.000	.000	.000	.000	1.00	.000	.000	.000	.000
	SNNP	1487	.000	.000	.000	.000	.000	.000	1.00	.000	.000	.000
	Gambela	608	.000	.000	.000	.000	.000	.000	.000	1.00	.000	.000
	Harari	566	.000	.000	.000	.000	.000	.000	.000	.000	1.00	.000
	Addis Abeba	786	.000	.000	.000	.000	.000	.000	.000	.000	.000	1.00
	Dire Dawa	535	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
Age 5-year groups	15-19	859	1.00	.000	.000	.000	.000	.000				
	20-24	1702	.000	1.000	.000	.000	.000	.000				
	25-29	2172	.000	.000	1.000	.000	.000	.000				
	30-34	1638	.000	.000	.000	1.00	.000	.000				
	35-39	1555	.000	.000	.000	.000	1.00	.000				
	40-44	1148	.000	.000	.000	.000	.000	1.00				
	45-49	1061	.000	.000	.000	.000	.000	.000				
Religion	Orthodox	4654	1.000	.000	.000	.000	.000					
	Catholic	91	.000	1.000	.000	.000	.000					
	Protestant	1592	.000	.000	1.000	.000	.000					
	Moslem	3560	.000	.000	.000	1.00	.000					

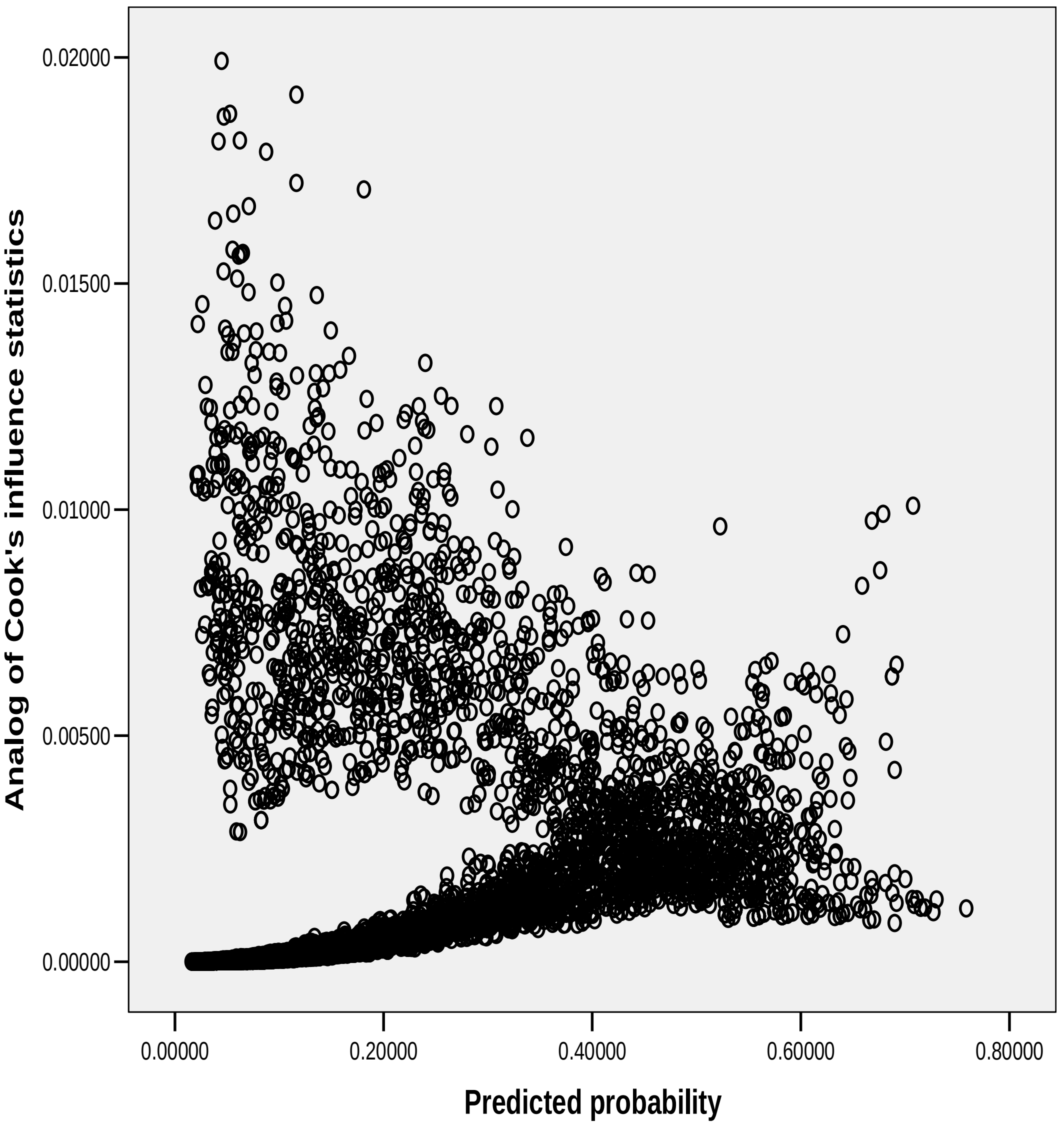
	Traditional	143	.000	.000	.000	.000	1.00					
	Other	95	.000	.000	.000	.000	.000					
partners	no education	5933	1.000	.000	.000							
educati	primary	2282	.000	1.000	.000							
on level	secondary	1554	.000	.000	1.000							
	higher	366	.000	.000	.000							
Frequen	Not at all	6033	1.000	.000	.000							
cy of listenin	Less than once a week	2495	.000	1.000	.000							
g to radio	At least once a week	289	.000	.000	1.000							
	Almost every day	1318	.000	.000	.000							
educati	no education	7388	1.000	.000	.000							
onal	primary	1586	.000	1.000	.000							
attianm	secondary	993	.000	.000	1.000							
ent	higher	168	.000	.000	.000							
wealth	poor	4047	1.000	.000								
index	middle	1627	.000	1.000								
	rich	4461	.000	.000								
place of residenc	Urban	2335	1.000									
e	Rural	7800	.000									
Visited by FP	No	9410	1.000									
worker last 12m	Yes	725	.000									
Heard	No	7247	1.000									

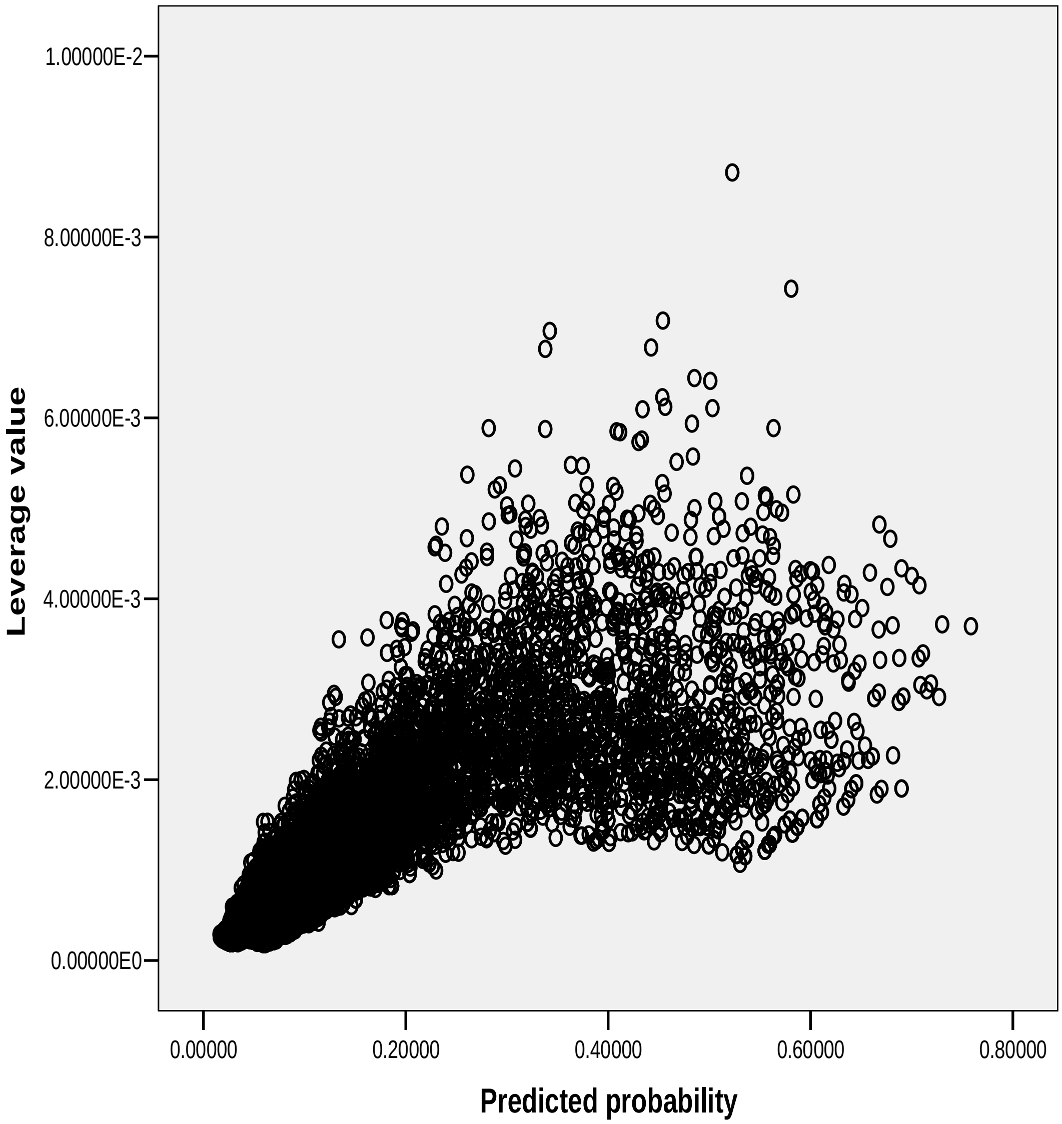
FP on radio last months	Yes	2888	.000									
Respondent currently working	No	7245	1.000									
	Yes	2890	.000									

Descriptive Statistics of diagnostic tests

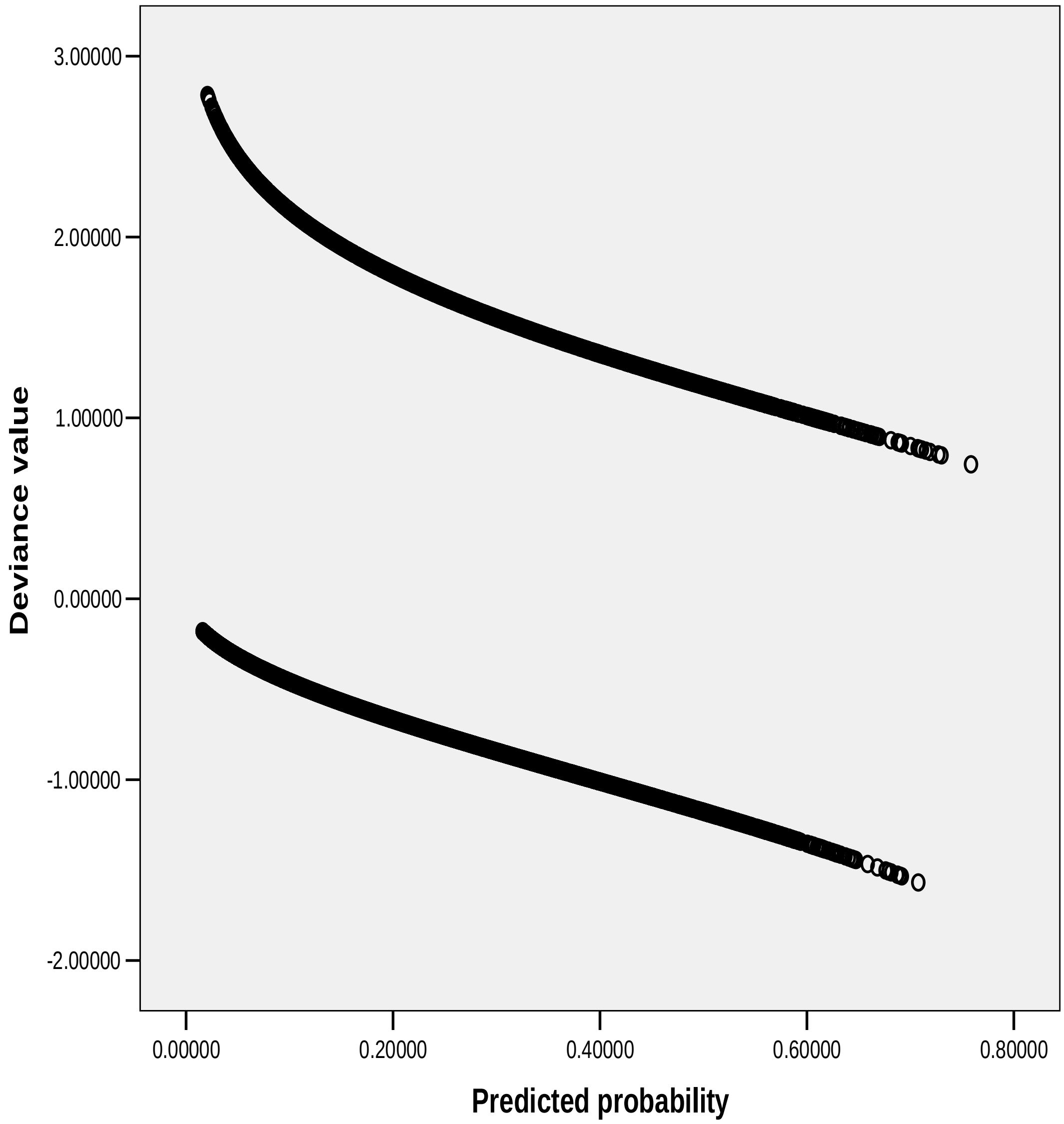
	N	Minimum	Maximum
Analog of Cook's influence statistics	10135	.00000	.01992
Leverage value	10135	.00018	.00871
Standard residual	10135	-1.57163	2.78533
Deviance value	10135	-1.56837	2.78501
DFBETA for constant	10135	-.01669	.03047
DFBETA for education	10135	-.00323	.00410
DFBETA for wealth	10135	-.00400	.00222
DFBETA for partner.edu	10135	-.00289	.00329
DFBETA for age	10135	-.00086	.00120
DFBETA for lis.radio	10135	-.00155	.00283
DFBETA for region	10135	-.00045	.00053
DFBETA for religion	10135	-.00113	.00192
DFBETA for residence	10135	-.00857	.00490
DFBETA for FP.radio	10135	-.00378	.00530
DFBETA for FP.visit	10135	-.00651	.00886
DFBETA for working	10135	-.00230	.00321
Valid N (listwise)	10135		

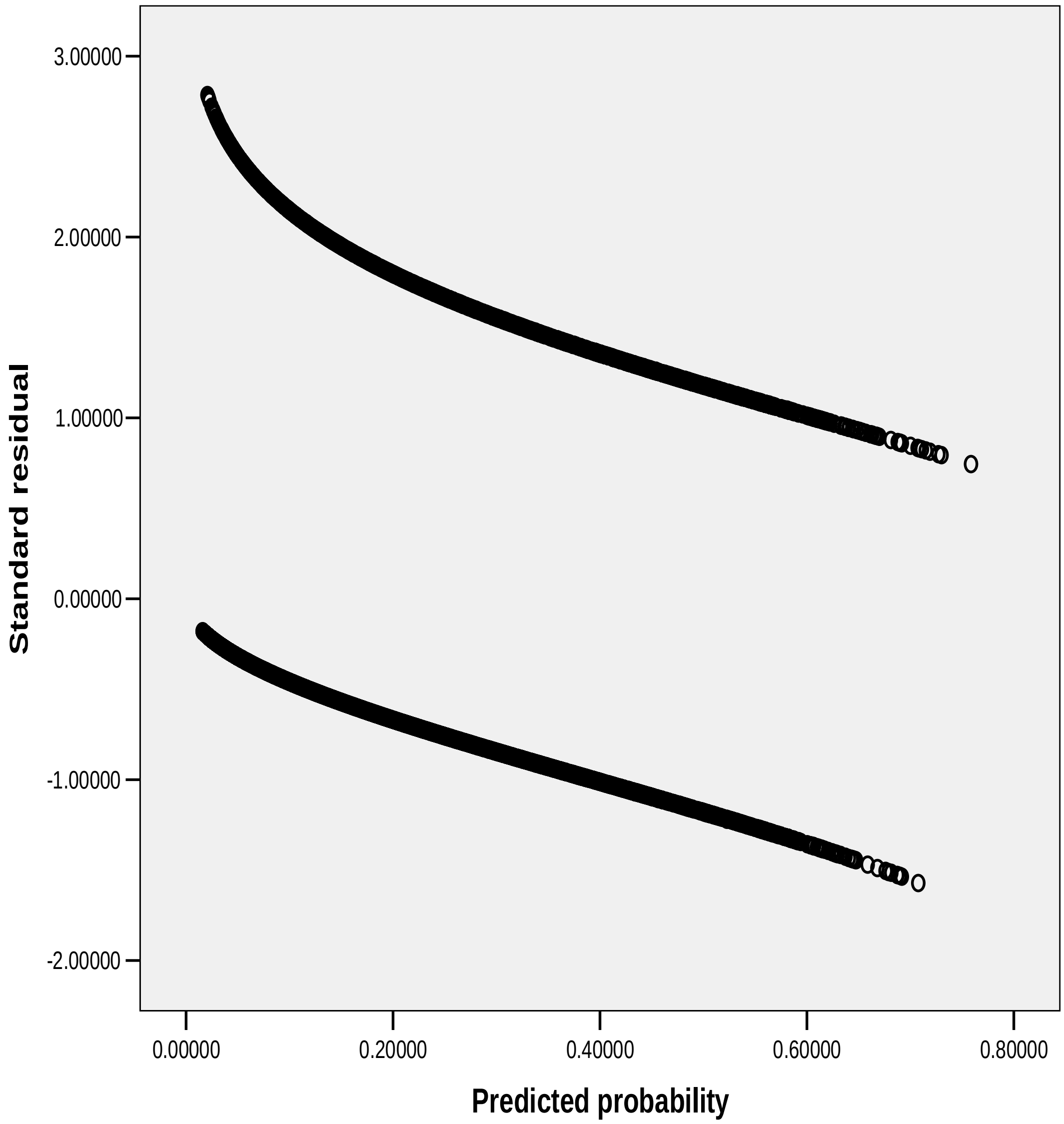
Scatter plots for diagnostic checking





1.00000E-2
8.00000E-3
6.00000E-3
4.00000E-3
2.00000E-3
0.00000E0
Leverage value
0.00000
0.20000
0.40000
0.60000
0.80000
Predicted probability


3.00000
2.00000
1.00000
0.00000
-1.00000
-2.00000
Deviance value
0.00000
0.20000
0.40000
0.60000
0.80000
Predicted probability


3.00000
2.00000
1.00000
0.00000
-1.00000
-2.00000
Standard residual
0.00000
0.20000
0.40000
0.60000
0.80000
Predicted probability

Declaration

I, the undersigned, declare that the thesis is my original work, has not been presented for a degree in any other university and that all sources of material used for the thesis have been duly acknowledged.

Declared by

Name: **Bezarede Mekonnen**

Signature: ______________________

Date: May ______________________

This thesis has been submitted for examination with my approval as a University Advisor.

Name: **Ato Mekonnen Tadesse (Assistant Professor)**

Signature: ______________________

Date: May ______________________