FACTORS INFLUENCING FEMALE FOOD-FOR-WORK PARTICIPATION IN THE SOUTHERN SHOA REGION OF ETHIOPIA

by

Alem Bantayehu

Thesis submitted to the Faculty of
Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

in

Agricultural and Applied Economics

APPROVED:

Daniel B. Taylor, Co-chair

Irma Silva-Barbeau, Co-chair

George W. Norton

October 1994
Blacksburg, Virginia

FACTORS INFLUENCING FEMALE FOOD-FOR-WORK PARTICIPATION IN THE SOUTHERN SHOA REGION OF ETHIOPIA

by

Alem Bantayehu

Daniel B. Taylor, Co-chairperson

Irma Silva-Barbeau, Co-chairperson

Department of Agricultural and Applied Economics

(ABSTRACT)

This study analyzes the factors influencing female food-for-work (FFW) participation in the Southern Shoa region of Ethiopia. The objectives are to determine the significant factors that affect women's participation in FFW projects and to explain this behavior with socio-economic and other factors.

Using data from a public works project conducted in 1991 by the International Food Policy Research Institute (IFPRI), the Ethiopian Nutrition Institute (ENI) and the Institute of National Nutrition (INN), analyses were done on a sample of 655 females from three *awrajas* (districts) in Southern Shoa. The sample consisted of 28.4 percent females who participated in FFW and 71.6 percent who did not participate in FFW

activities. More than 85 percent of the female sample had no education, over half were single and 48 percent of the women were unemployed.

A logit probability model was used to explain women's participation in FFW projects. The results indicate that family size, occupation, marital status, reproductive status, total non-food expenditures, amount of output sold from agricultural production, women's wages from FFW and wages from other agricultural work were the most significant factors influencing female FFW participation. The family size variable had the most significant impact on increasing women's probability of participating in FFW projects.

For the study's sample, women with larger family sizes are more likely to participate in FFW projects. Those who are not gainfully employed are also more likely to participate in FFW activities since they view FFW as a source of employment. Women in polygamous households are less likely to participate in FFW than women in monogamous households. In terms of a woman's reproductive status, those who are not pregnant and not lactating are more likely to participate in FFW programs. It was found that the greater the non-food expenditures incurred by the household, the more likely women participate in FFW; the less output sold from agricultural production, the greater the likelihood that women engage in FFW; the higher a woman's wages from FFW, the more they were attracted to FFW programs; and interestingly, the higher the wages from agricultural work (non-FFW), the more likely they participate in FFW activities.

ACKNOWLEDGEMENTS

This thesis was written under the supervision of Professor Daniel B. Taylor and Adjunct Professor Irma Silva-Barbeau, and was funded by USAID/TSMM. I owe a debt of gratitude to both Dr. Daniel B. Taylor and Dr. Irma Silva-Barbeau for serving as co-chairpersons of my graduate committee. Their patience with changes in research projects and their concerns as a whole were irrefutable. Dr. George Norton also deserves recognition for serving on my committee. I would like to extend my sincere appreciation to him for giving me the opportunity to be a part of this department.

I wish to acknowledge the utmost cooperation of Dr. Shubh K. Kumar of the International Food Policy Research Institute (IFPRI) without whose assistance this study would not have been completed. I am grateful for her willingness to take part in this study and for her flexibility in adjusting to our needs here at VPI. I would also like to thank Saroj K. Bhattari for successfully compiling the data files needed for this study and for assisting me while I was at IFPRI. Your collaboration is very much appreciated.

In Ethiopia, a warm thank you to Dr. Zewde Wolde Gabriel and Dr. Hana Tibeb of ENI for the information relayed to me about the FFW projects in Ethiopia. I would also like to express my sincere gratitude to Yohannes Habtu (who was then research assistant with ILCA) for his valuable time spent on guiding me through questionnaires and introducing me to other officials who were involved in the project. I thank you all for the warm welcome during my short, but rewarding visit to Addis Ababa.

There are many friends, both here at VPI and nationwide, whom I would like to thank for their support and understanding. I would first, like to thank the Ethiopian

community at VPI for their motivation, aspiration and belief in me. I must confess that without each and every one of you, I would not have had the strength to carry on.

Also, to secretary Judi Baran, thank you for your moral support and for the crash courses on how to create equations and figures on Wordperfect. I wish to thank Todd Pukanecz in the micro computer lab for dealing with the majority of the computer processing that was needed to obtain data from different files and sources. You were of tremendous help.

For the times that I needed to put all work aside and have peace of mind, I thank Yoni for spending several hours and days with me at Mill Mountain Cafe sipping *darjeeling* tea. For the slight shove that I needed to get through this program, I am indebted to 'Cheryl the Great' without whom these past two years would have been insipid. To my best friend of seven years, Misti, I now have an answer to your consistent question asking "When are you getting out of school?" The time is now.

Most importantly, I want to thank my sister Mimi for her patience not only throughout these two years in graduate school but also for putting up with me during my undergraduate years. I also want to recognize my Nefse for all his advice and for giving me the courage to pursue a master's degree. You always manage to know what is right for me.

And last but not least, I would like to thank my parents and my brothers for their encouragement and understanding. I am grateful for the values that I have been taught and for the person that it has made me today. I love you all very deeply.

TABLE OF CONTENTS

GLOSSARY OF ABBREVIATIONS

AAFS-Advocates for African Food Security

EIU-Economic Intelligence Unit

ENI-Ethiopian Nutrition Institute

FAO-Food and Agriculture Organization

FFW-Food-for-Work

FHI-Food for the Hungry International

GDP-Gross Domestic Product

GNP-Gross National Product

IFPRI-International Food Policy Research Institute

ILCA-International Livestock Center for Africa

INN-Institute of National Nutrition (ITALY)

LIMDEP-Limited Dependent (PROGRAM)

MLE-Maximum Likelihood Estimation

NGO-Non-Government Organizations

OLS-Ordinary Least Squares

PA-Peasant Associations

WFP-World Food Program

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

I.1 FOREWORD

In most of the developing world today, women are responsible for a significant percentage of total food production. In most cases, they are not included in the planning and management of the food assistance distribution process. The dynamics of household resource allocation indicate that in many cases, the transfer of food aid will have different impacts depending upon who receives it (AAFS, 1989). Based on the knowledge about women's productive and reproductive[1] role in society, women may face special constraints which, if not addressed, will limit the overall impact of food assistance programs. It is important, therefore to assess the participation of women as agents and beneficiaries of food assistance programs.

This study is conducted in collaboration with IFPRI (International Food Policy Research Institute), ENI (Ethiopian Nutrition Institute) and INN (Institute of National Nutrition) to determine the significant factors that influence women to participate in food-for-work (FFW) programs.

---

[1]the term 'reproductive' is defined as a woman's role in child bearing and rearing throughout this study.

I.2 PROBLEM STATEMENT

The adverse food and nutrition situation in Africa today is one aspect of Africa's underdevelopment (McGuire, 1990). Health and the general well-being of the poor are directly dependent on both food and nutrition, therefore efforts must be made to alleviate the problem of food shortages and the low nutritional status among the poor.

In much of Africa, women are the primary food producers as well as the primary actors in local food distribution. It has been estimated that 80 percent of Africa's food is produced by women (AAFS, 1989). They are primarily responsible for planting, weeding, tilling, harvesting, storage, preservation, marketing and food processing. Women also spend a considerable amount of their time fetching water and gathering fuelwood for household consumption. They also bear major responsibilities for child care and overall household maintenance. Figure 1.1 illustrates the percentage of time spent in different activities by women in Africa.

Despite their significant contributions, particularly in food production, women's productivity is still low due to economic and socio-cultural constraints. Their participation in the development process is still marginal. They have limited access to education and training, and they have limited access to resources such as land, water, fuel and appropriate technologies.

Rural women in Africa are among the poorest and most vulnerable people in the world, and the incidence of their poverty is increasing (WFP, 1992). It has become increasingly clear that targeting benefits to the poor in general, and hoping women will

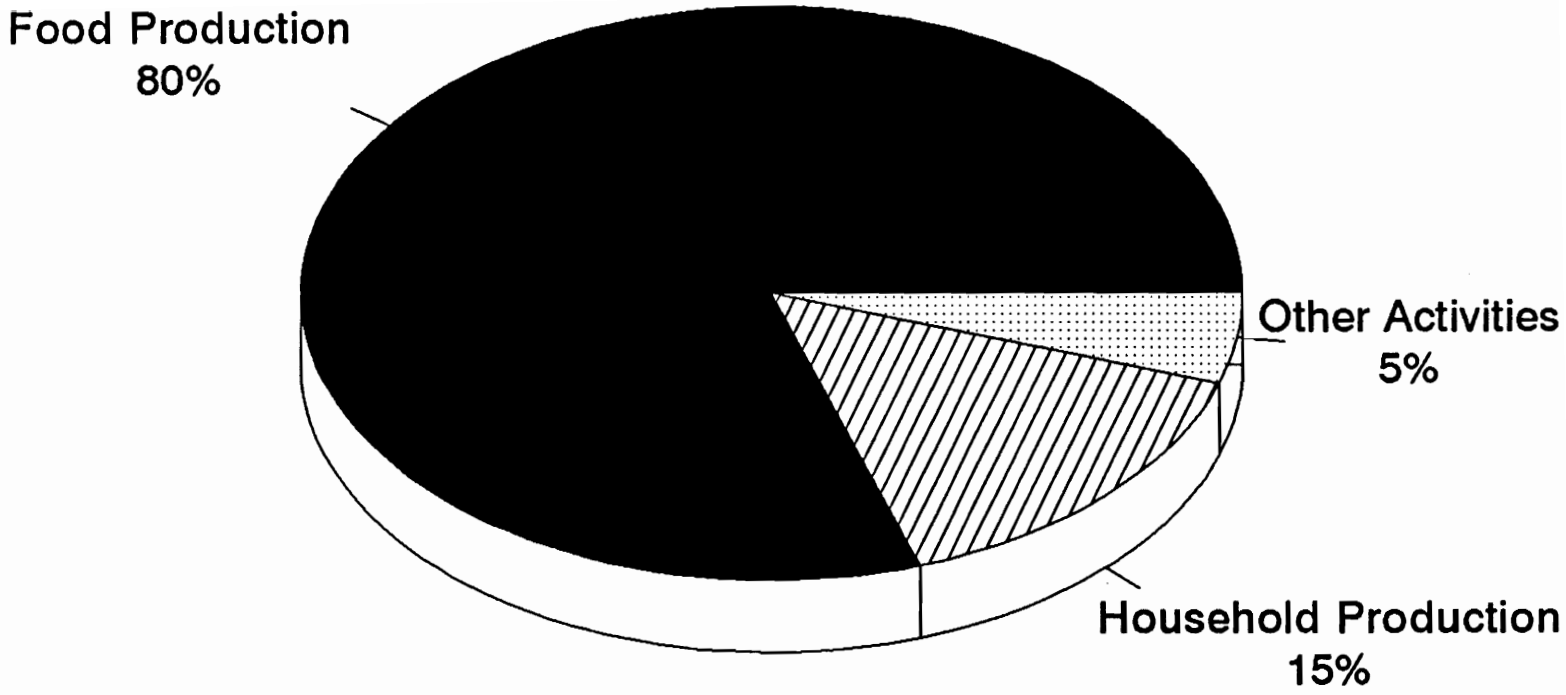

Figure 1.1 Percentage of Time Spent on Different Activities by Women in Africa

Source: AAFS, 1989

get their share, simply does not work (FAO, 1985). Any poverty alleviation efforts, therefore, must promote the advancement of women as producers in their own right.

In the past, numerous public schemes have been used to alleviate hunger and malnutrition among the poor, some more effectively than others. For example, disasters such as famine and drought can be averted by increasing the purchasing power of those with the least ability to obtain food (Sen, 1993). Women and children are the most vulnerable groups when it comes to hunger and malnutrition. Public works programs, such as the building of roads and wells, the expansion of irrigation systems and the diversification of food production have been used in several countries to reduce poverty. Food-for-work (FFW) is one type of public works program that has had some success in trying to improve the welfare of the poorest segments of a household (Clay, 1991).

FFW was introduced in the mid 1970's as a means of utilizing food aid as payment for work on public works programs in food deficit countries. The specific aim of FFW programs is to design projects where food is directly distributed in exchange for labor. Most of the public works activities are donor driven and often are in direct response to acute food insecurity. They have the potential for simultaneously meeting some of the critical needs for improving rural welfare and sustainable rural development (von Braun, 1991).

In a study conducted by Kumar (1993), it was found that the benefits of FFW projects in Africa are twofold: 1) in the short run, they provide a type of food security whereby food transfers can alleviate seasonal food shortages and promote allocation of

household labor and cash resources to agricultural production; and 2) in the long run, FFW programs serve as payment for work on a community's infrastructure via the transmission of improved technologies. Ideally, such programs increase employment opportunities, increase agricultural output and contribute to more equitable distribution of income.

FFW programs can be considered a development tool to alleviate poverty as long as participants are provided with new skills that will result in more secure income earning ability. FFW should be designed to create income generating assets for participants and should provide improved health and nutrition for recipient families. In designing FFW projects, it is particularly important to recognize women because of their important role in food production.

One of the objectives of FFW is food security which is defined as a "households' permanent access to food in sufficient quantity and quality for an active and healthy life" (von Braun, 1991, p.34). Women constitute the bulk of the agricultural labor force, therefore, they should have a powerful influence over household food security as well as the allocation of resources within the household. Projects designed to mobilize rural labor, especially those utilizing food aid, need to be better designed to support and mobilize women's contribution to development (McGuire and Popkin, 1990). Special efforts should be made in formulating policies, programs and projects to involve women in order to improve their technical capabilities as well as their income earning opportunities.

I.3 SITUATION IN ETHIOPIA

In Ethiopia, there have been periodic famines caused by drought that have impoverished the local population. As a result, there is increasing poverty and people have become more and more vulnerable to hunger. Since the late 1980's population has grown at a rate of 3.2 percent while agricultural production has grown at a rate of -0.4 percent (World Bank, 1992). This leaves a wide gap between food needs and production. The demand for participation in public works programs has been increasing due to a rise in population growth, low labor productivity in agriculture, high levels of malnutrition, low per capita food availability trends and the effects of structural adjustment programs on employment (Sen, 1993).

A food-for-work study was carried out by IFPRI/ENI/INN to understand the magnitude and characteristics of food insecurity and the characteristics of the population that faces it. The study was conducted in three districts of Ethiopia's Southern Shoa region, Alaba-Siraro, Sike and Omo-Shelleko, between August 1990 and November 1991. Observations were made on seasonal patterns of food consumption by interviewing both FFW and non-FFW participants that would allow for inferences to be drawn about general aspects of rural life in Ethiopia.

The study found that 28 percent of households participated in FFW projects (Kumar, 1993). Food-for-work participants were drawn from a cross section of the population. Poorer, lower asset based households had a tendency to participate more in these projects and thus were able to benefit from higher incomes. Wage rates were

higher in FFW projects than working on one's own farm, therefore participants tended to remain in these programs rather on their own farm. Kumar's (1993) study concluded that FFW programs had a favorable impact on income distribution but did not target larger income gains to the worse off households.

A substantial seasonality in FFW employment was also found through this study. The highest time of employment was between August and September, before the harvest period for maize when there was lower agricultural labor demand and lower food supply. The pre-harvest period is the hungry period because it is the dry season, therefore a large proportion of farmers engaged in FFW activities. The lowest time of employment was from October through December, during and after the maize harvest (Kumar, 1993). Although the majority of the participants were employed in FFW during the preharvest season, when there was least demand for agricultural work, there is the tendency to neglect labor in the agricultural sector when participating in FFW projects.

Women provided only about 30 percent of the labor in these FFW projects (Kumar, 1993). They had limited access to productive resources. A major element of poverty-oriented interventions should, therefore, be focused on improving the economic status of women. Efforts should be made to channel resources directly to them to increase their productivity and to increase their participation in the development process.

I.4 GENERAL GOAL AND OBJECTIVES

The general goal of this study is to determine the significant factors affecting women's participation in FFW programs in the Southern Shoa region of Ethiopia. The specific objectives are:

(i)To investigate what factors influence women's participation in FFW projects; and

(ii)To determine the effects of changes in the significant factors on the probability of women's participation in FFW projects.

I.5 ORGANIZATION OF THE STUDY

This thesis is divided into six chapters. The socio-economic environment of the study areas will be presented in Chapter 2. Chapter 3 develops a theoretical model for evaluating female FFW participation. Chapter 4 presents the empirical model and methods used in the study. Chapters 5 and 6 contain the results and conclusions of the study respectively.

CHAPTER II

THE STUDY AREA

II.1 BACKGROUND ON ETHIOPIA

Ethiopia is located in East Africa, also known as the Horn of Africa, and occupies an area of approximately 1,223,000 square kilometers. The Central Statistical Office estimated a population of 50 million inhabitants in 1991-92. The country is divided into provinces, each province into *awrajas* (districts) and each *awraja* into *weredas* (sub-districts). Figure 2.1 shows a map of Ethiopia and the provincial boundaries. There are a total of 102 *awrajas* and 571 *weredas*. The *weredas* are the lowest administrative unit in rural communities of Ethiopia (Mirotchie, 1989).

Ethiopia is partitioned into dry and rainy seasons; the dry season is from November-March and the rainy season is from April-October. Due to this extended period of rainfall, the area's crop cultivation possibilities are better than the majority of the sub-Saharan savannahs. There are two harvests in Ethiopia: the belg (short rains) in mid-year which provide about 10 percent of the crops, and the meher (long rains around September and October), which provide the main harvest in November and December (EIU, 1992). Because of the semi-arid nature of the region and the long maturation

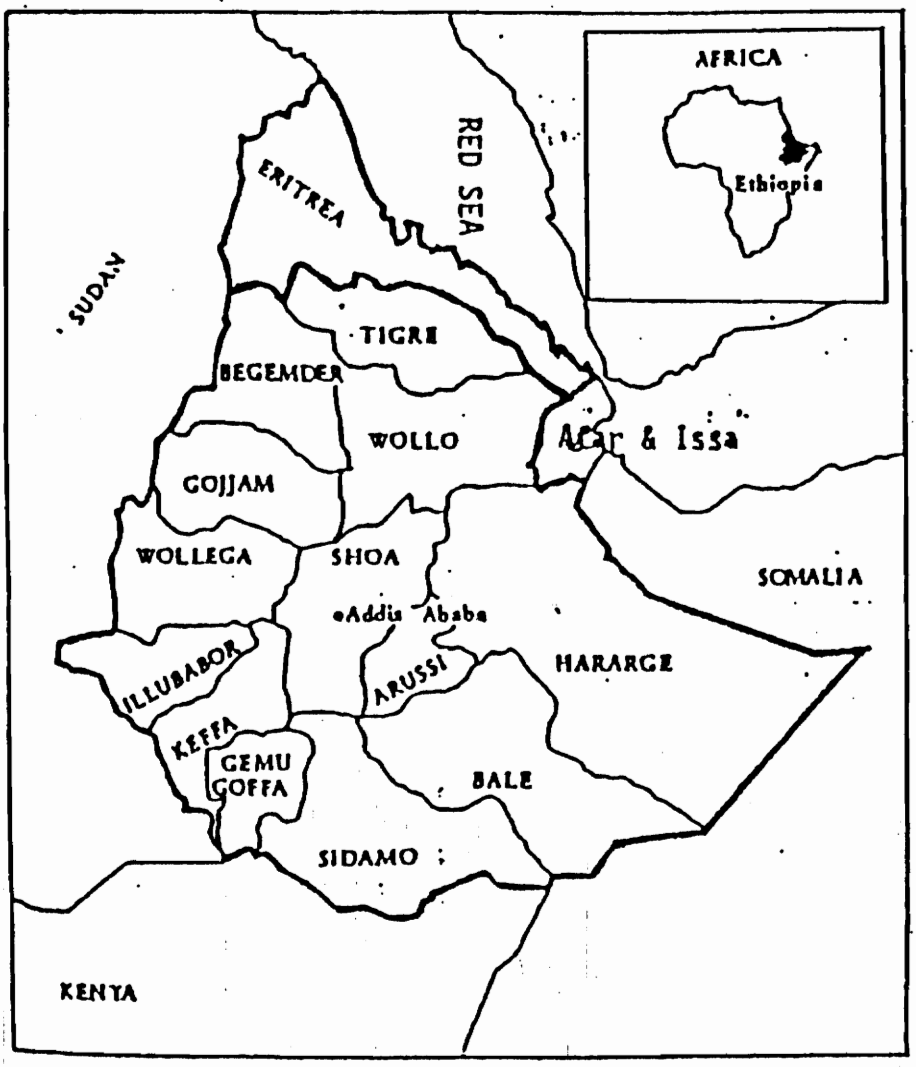

FIGURE 2.1 Map of Ethiopia and the Provincial Boundaries

Source: Mirotchie, 1989

times of local maize varieties, most farmers cannot get two crops to grow in Southern Shoa unlike in the high rainfall regions of Ethiopia.

Agriculture is the backbone of Ethiopia's economy, accounting for 45.8 percent of GDP in 1988-89 (EIU, 1992). During the 1980-91 decade, the agriculture sector in Ethiopia had an average annual growth rate of 4.9 percent. Table 2.1 gives a summary of the basic economic indicators of Ethiopia. Ethiopia has a per capita GNP of $120 compared to $270 for the average of other low-income countries. The average annual GNP growth of these low-income countries was 3.1 percent whereas for Ethiopia it was a mere 0.6 percent, making it the lowest annual growth rate in the world.

The southern region of Ethiopia produces approximately 80 percent of the country's total agricultural output. Even though agriculture received 23.3 percent of all public investment in the 1980-88 period, production fell by an average of 0.8 percent per year (EIU, 1992). This poor performance can be explained by the droughts. The 1987-88 drought led to a 50 percent reduction in the cereal harvest and left millions of people dependent on food aid and food assistance programs.

Agroecological zones define the average environmental conditions suitable for best growth of cereals such as an indigenous grain called *teff*, wheat, barley, maize and sorghum. For example, *teff* is commonly grown at an altitude range of 1,700-2,400 meters where it receives an average rainfall of above 300mm (Mirotchie, 1989).

Table 2.1 Basic Economic Indicators of Ethiopia

GNP per capita in dollars (1991)

Low-income countries	270	Ethiopia	120

Ave. annual GNP p.c. growth rate 1980-91 (%)

Low-income countries	3.1	Ethiopia	0.6

Ave. annual inflation (%)

	1965-80	1980-91
Low-income countries	4.6	8.1
Ethiopia	3.4	3.4

Ave. annual growth (%) in the different sectors (1980-91)

	GDP	Agriculture	Industry	Manufacturing	Services
Low-income countries	0.8	3.9	3.8	3.0	5.0
Ethiopia	1.9	-0.4	3.3	3.6	4.1

Source: World Development Report, 1992

Barley is prevalent between 1,800-2,200 meters receiving an average rainfall of 240mm. Regions that are situated below or at 2,200 meters and get more than 400mm of rain are suitable mainly for maize production as is the case of the Southern Shoa region (Kumar, 1993).

At the local level, villages are grouped into Peasant Associations (PA's) which were set up in 1975 to help with land redistribution. Created by the revolutionary government, the PA's became the smallest administrative entities ranging from 800 hectares of land to 4,000 hectares (Pankhurst, 1992). PA's provided a local structure with which the state could interact. Each association was headed by a chairman, a deputy chairman and a secretary, usually all male.

II.2 SELECTION OF STUDY AREA

To determine the factors influencing female FFW participation in the Southern Shoa region of Ethiopia, this study looks at a sample of over 600 women taken from a public works project in Ethiopia conducted jointly by IFPRI/ENI/INN in 1990-91. The reason for selecting Ethiopia as the focus of this study is: 1)Ethiopia faces tremendous food deficit problems, chronic malnutrition and rising food aid requirements; 2)research results are available from a previous study that determines the effects of FFW on agricultural production, income, capital investment and employment by participants in

the Baringo District in Kenya, a neighboring country of Ethiopia (Bezuneh, 1985); and 3)a data base on public works and their influence on seasonal food security in Ethiopia was available. This study was based on this data base.

The study area is located in the Southern Shoa region in the *weyna dega* (midlands) of rural Ethiopia. The total population size of the Shoa region is 9,333,735 with a density of 43 persons per square kilometer (Kumar, 1993) making it the most populous and the fastest growing region of Ethiopia. With an area stretching over 85,094 square kilometers, it is one of the largest administrative units of Ethiopia. All of the population selected for this research reside in the rural parts of the districts. The people in the midlands are predominantly engaged in livestock and crop production.

Three *awrajas* were selected from the province of Southern Shoa to represent the ecological and socioeconomic variations of the midlands. In relation to the rest of Ethiopia, these three *awrajas* are located in the southwestern part of Ethiopia lying next to the Omo River. Figure 2.2 shows the three research sites: I-Omo-Shelleko, II-Sike and III-Alaba-Siraro. The data used in this study was collected from eleven rural peasant associations from these three administrative districts. Table 2.2 lists the characteristics of the peasant associations. Since the highlands were not easily accessible, the PA's chosen were in the lowlands and the midlands. Only six of the PA's had FFW programs on site: Tuka and Choroko in Alaba-Siraro, Geigera in Sike, Bachira, Semien and Geicha in Omo-Shelleko.

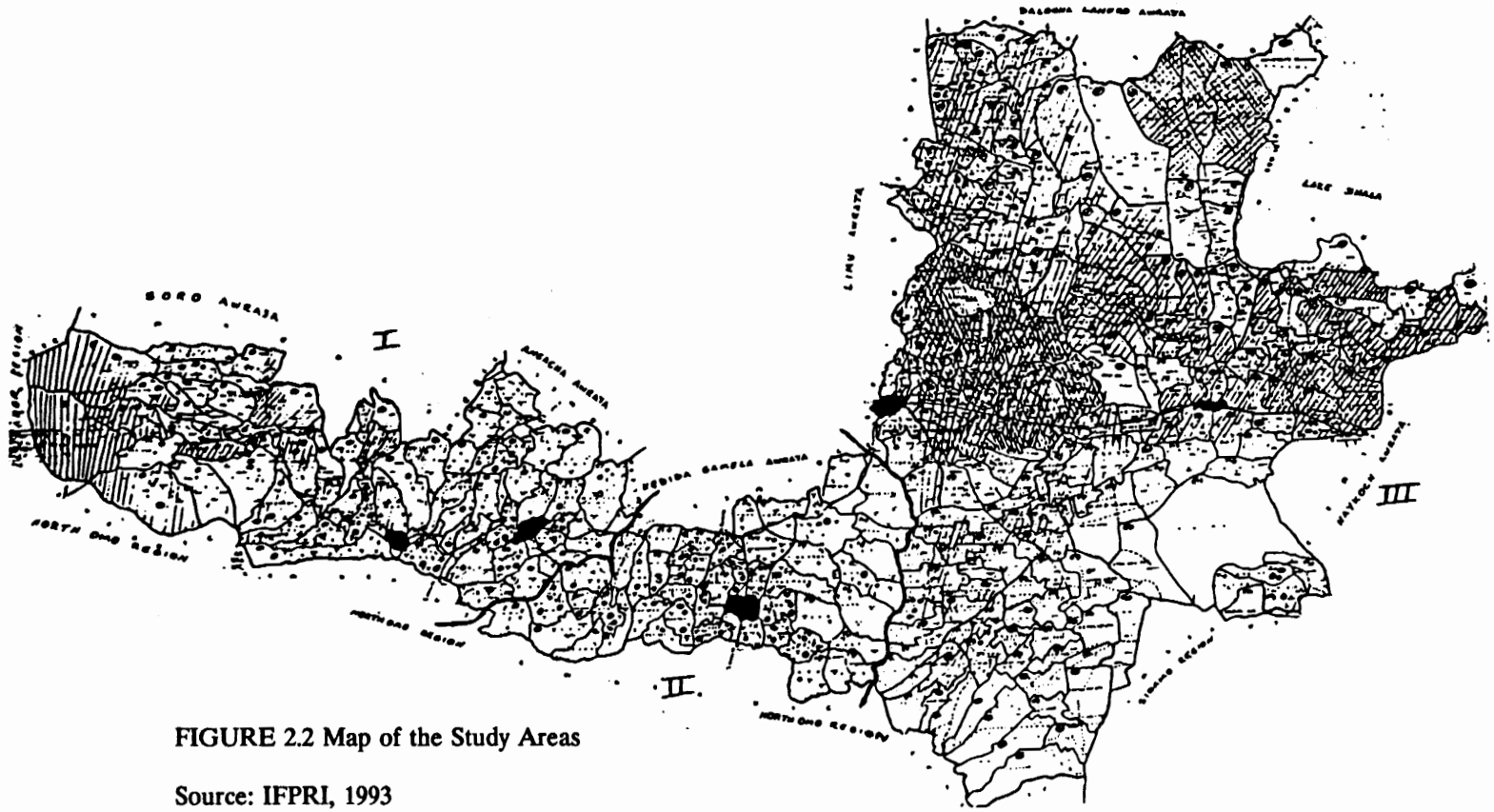

FIGURE 2.2 Map of the Study Areas

Source: IFPRI, 1993

Table 2.2. Characteristics of the Peasant Associations in the Study Area

Peasant Associations	FFW	Description	*Awrajas*
Kemo	no	midlands[2]	Alaba-Siraro
Welality	no	lowlands[3]	Alaba-Siraro
Tuka	yes	midlands	Alaba-Siraro
Choroko	yes	lowlands	Alaba-Siraro
Sepera	no	lowlands	Sike
Koto	no	midlands	Sike
Geigera	yes	lowlands	Sike
Bulgita	no	midlands	Sike
Bachira	yes	lowlands	Omo-Shelleko
Semien	yes	midlands	Omo-Shelleko
Geicha[4]	yes	lowlands	Omo-Shelleko

Source: Kumar, 1993

[2]midlands are located 1,600-2,000 meters above sea level.

[3]lowlands are located below 1,600 meters above sea level.

[4]Geicha was the largest PA with the most FFW activity.

The three particular study sites, Omo-Shelleko, Sike and Alaba-Siraro, were chosen to take into account the seasonal patterns of labor demand and allocation in agriculture as well as the availability of food (Kumar, 1993). The agroecological zones, the availability of public works projects, access to infrastructure and one's ethnic origin were the characteristics of most interest for the Kumar (1993) project on seasonality. The study area was further divided into lower and higher altitudes due to major cropping differences (Kumar, 1993).

A variety of crops are produced in the Shoa region. The major crops are cereals, beans and legumes, roots and tubers and cash crop such as coffee, sugar, cotton and tobacco. Other main crops are barley, *teff, enset* (false banana), maize and millet. Table 2.3 shows the crops planted by area in hectares in the Shoa region. Maize and *teff* were planted the most at .83 and .38 hectares per farm.

The sampling criteria for the study sites included: 1)whether or not NGO's (Non-Government Organizations) operated other FFW projects in these districts; 2)access to roads and market towns; and 3)improved inputs for agricultural productivity. Religious affiliation was also considered since it may sometimes alter seasonal food consumption patterns.

Table 2.3 Crops Planted in Hectares per Farm in the Shoa Region

TOTAL AREA CULTIVATED IN HECTARES		
CROP	**MEAN**	**SD. DEV.**
MAIZE	.83	.86
TEFF	.38	.35
OTHER CEREAL	.23	.24
BEANS & LEGUMES	.17	.17
ENSET (BANANAS)	.05	.08
ROOTS & TUBERS	.13	.12
OTHER CROPS	.03	.05

Source: Kumar, 1993

II.3 PARTICIPATION IN FFW

There were several NGO's operating FFW projects in the study areas. World Vision, Concern, and FHI (Food for the Hungry International) were among the many that provided relief during periods of acute food scarcity and continued to do so in post drought periods as developmental programs. The main types of programs introduced were road upgrading, soil conservation, reforestation, dam construction for irrigation and other water supply projects (Kumar, 1993).

The procedures used for selecting participants varied by NGO's. Some based the decision of who to select for FFW programs on those who showed up for work, those with high physical fitness levels, and the most needy members of the community. The selection itself was made by local PA leaders. The villagers claimed that the selection did not reflect need, but rather it was a function of the households' relationship with the local leadership.

It is expected that FFW programs target the worst off segments of a population because many FFW programs are in famine prone areas. Anytime food is associated with a program, it is expected to reach the neediest segments of the population. However, there is no evidence to support this.

The nature of the work and returns to labor in agricultural production or employment are also important factors influencing participation. FFW projects in most cases involve heavy manual labor that is more strenuous than agricultural work. This may act as a disincentive to the better off rural households and to women. However, since wages are not set on a piece work basis, but rather on a daily basis, if the worst off are able to participate they are likely to receive wages better than their returns to

labor from their own farms. Both these factors are likely to attract the worst off groups and those with lower returns to alternative employment into the program.

The wage rates of the public works programs in the three districts of Southern Shoa varied from one NGO to another, but in all cases, they were higher than the prevailing agricultural wage rates and there was a high demand for this type of employment. The standard wage rate in the more established NGO's was 3kg of wheat plus 4oz of cooking oil per day, which was sufficient to encourage FFW participation although not high enough for subsistence (Kumar, 1993). This food when translated into Birr using prices at the post harvest price levels (low point of the year) came to about 2.25 Birr/day or $1U.S.

II.4 SELECTION OF HOUSEHOLD SAMPLE

Forty (40) households were selected from each of the eleven peasant associations from the three *awrajas* to participate in the study. Households were selected randomly and were expected to give a representative cross section of households in each peasant association. The average household size was seven; three adults and 3 to 4 children (Kumar, 1993). Table 2.4 shows the household characteristics in the study area. Of all the members of households, 86 percent reported agriculture as their major occupation. Only 18.6 percent of both male and female members of households reported being able to read and write. Married women constituted about 40 percent of the entire population

Table 2.4 Characteristics of Households in the Study Area

Characteristics[5]	#
Total # of households	40
Average household size	7
Agriculture as major occupation	86%
Literacy rate	18.6%
Polygamous relationship	30%
Married/monogamous	40%
Pregnant/Lactating	5.6%
Female headed households	12%
Children < 13 years per household	5%

Source: Kumar, 1993

[5]These characteristics are for both male and female members of the households in the study area.

and 30 percent were involved in a polygamous relationship. Female headed households comprised only 12 percent of households and they reported housework as their major occupation (Kumar, 1993).

A survey on agricultural production was also used to complete the harvest information and to capture seasonal variations. Ten rounds of household interviews 4 to 6 weeks apart were conducted between August 1990 and November 1991. The agricultural characteristics of these rounds are depicted in Table 2.5. The rounds refer to the repeat visits which were carried out over a 15 month period. Rounds 1 and 9 of the survey are during the preharvest period in 1990 and 1991 respectively. Maize and *teff* are harvested during the dry season months of October through March (rounds 2 through 6).

For one whole year, it was found that nearly 30 percent of households reported participating in FFW programs. However, at any one point in time, the maximum was just under 10 percent. The highest proportion of households participated during rounds 1 and 9 of the survey, immediately preceding the main maize harvest (Kumar, 1993). There is a large local market which is also used for purchasing food during this preharvest period. Many farmers harvest their maize crop for fresh maize in July, and then replant the land with teff which is harvested in January. In this way, the farmers manage to use the land during a larger portion of the year.

Figure 2.3 contains a graphical representation of FFW participation by rounds which are explained in Table 2.5. This participation pattern demonstrates how people respond to periods of acute need. Participation in FFW decreases during the rainy season (rounds 6 through 8) when labor is required for planting and weeding. The peak

Table 2.5 Agricultural Characteristics by Rounds

ROUND	DATE	ACTIVITIES
1	Aug-Sep 1990	Preharvest period, Teff planting
2	Oct-Nov 1990	Maize harvest
3	Nov-Dec 1990	Maize drying, processing
4	Jan 1991	Teff harvest
5	Feb 1991	Land preparation for maize
6	March 1991	Maize planting
7	Apr-May 1991	Revolution, maize weeding
8	Jun-Jul 1991	Post Revolution, fresh maize
9	Aug-Sep 1991	Preharvest period, Teff planting
10	Oct-Nov 1991	Maize harvest

Source: Kumar, 1993

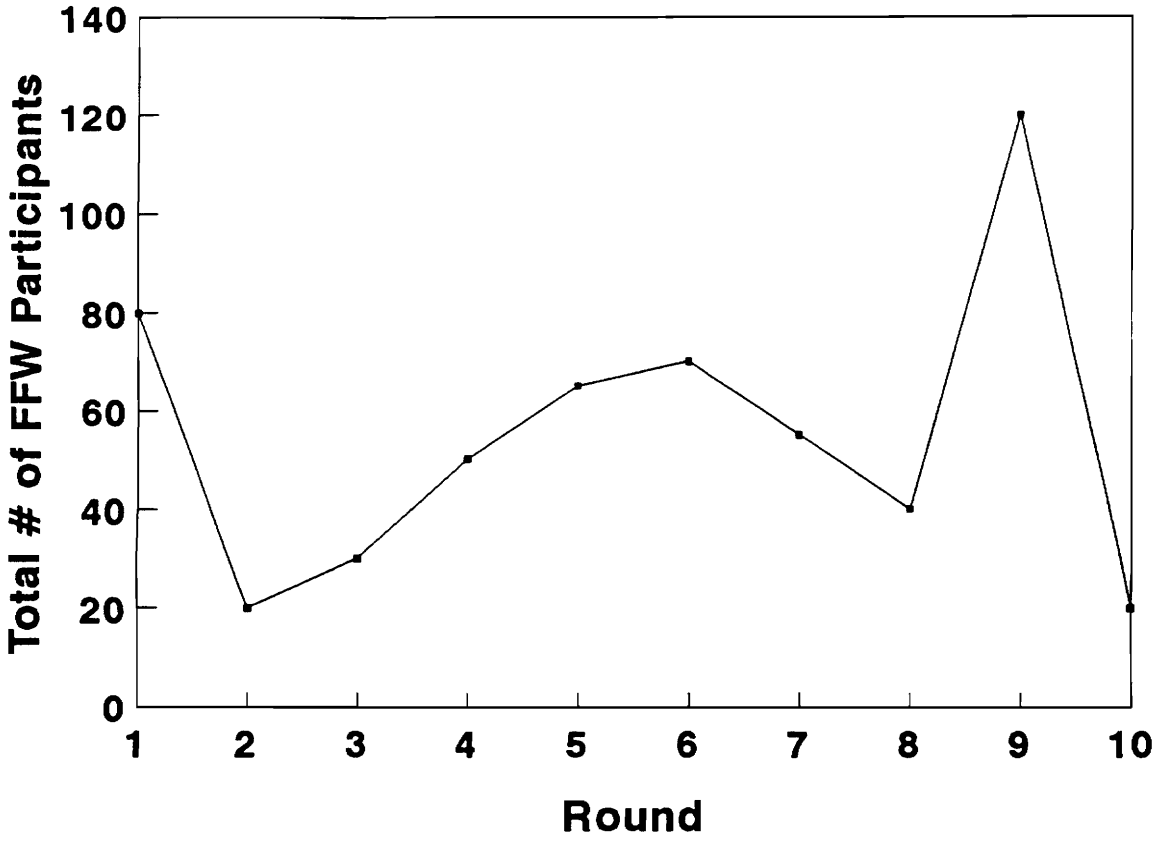

Figure 2.3 FFW Participation by Rounds

Source: Kumar, 1993

FFW employment occurs in the immediate preharvest period (round 9) when all crop preparations have been completed and food stores are at their lowest.

There was a wide diversity of religious and ethnic backgrounds represented in households. Table 2.6 depicts the religious backgrounds of these households. The two major religions are Christianity and Islam. There were however, five denominations among the Christians: Orthodox (19.3 percent), Catholic (8.1 percent), Adventist (0.3 percent), Mekane Yesus (9.7 percent) and Kale Hiwot (8.9 percent). Muslim households comprised of 35 percent of the sampled households and 14 percent belonged to animistic religious groups. No religious affiliation was reported by five percent of households (Kumar, 1993). The three major ethnic groups represented in the area were: Hadiya (20.5 percent), Kembata (44.8 percent) and Alaba (17 percent). Others had minor representation such as Silte (6.3 percent), Oromo (7.8 percent) and Wolay (2.5 percent) (Kumar, 1993).

Table 2.6 Religious Background of Households in the Study Area

Religion	%
Christians:	
Orthodox (Greek)	19.0
Catholic	8.1
Adventist	0.3
Mekane Yesus	9.7
Kale Hiwot	8.9
Muslims	35.0
Animistic	14.0
No religious affiliation	5.0

Source: Kumar, 1993

CHAPTER III

HOUSEHOLD DECISION THEORY

III.1 FOOD-FOR-WORK IN A THEORETICAL FRAMEWORK

Demographic changes and an increase in the female participation in the labor force have been observed in some developing countries. Therefore, female employment behavior as well as family decision making have received some attention in economic research. The characteristics of a household are often used to explain female labor supply. This chapter will introduce a household decision making model as a theoretical model that can be used to explain female FFW participation.

Microeconomic household theory traditionally was concerned with questions of labor supply and consumer behavior. No distinction was made between an individual or a household. New concepts in the late fifties to the mid 1960's however, such as the formalization of the human capital concept (Schultz 1959, Becker 1964) and of time costs (Becker 1965) have led to a new approach to household behavior: the analysis of optimal time allocation extended to include household production, and the question of different time allocation patterns of individual household members, especially female labor supply (Killingsworth and Heckman 1986).

The 'new home economics', which states that time allocation models operate with household utility functions which describe the joint interests of all household members, is applicable to nearly all household decisions. The household is regarded as a 'small factory' (Becker 1965, p.496) in which the basic commodities are produced for household members using market goods and time as inputs. "These commodities cannot be purchased in the marketplace but are produced as well as consumed by households using market purchases, own time and environmental inputs. These commodities include children, prestige, health, goals, envy, and are much smaller in number than goods consumed" (Becker 1981, p.7). Such a notion of household models allows for an explanation of household behavior as simultaneous decisions concerning consumption, labor supply and other household activities.

To participate in FFW programs, a change in the utilization of household labor is required. There must be a balance between labor performed outside the home and that performed on one's own farm. The allocation of household time to different labor activities can be examined by looking at the time available to the farm household. Women as a whole are faced with constraints in time and money. Any effort devoted to one of their numerous roles detracts them from fulfilling other roles. Programs that best minimize the conflicts in women's financial responsibilities, time commitments and family should be implemented. FFW is a program that has potential to enhance women's income. Engaging in FFW, however, may cause a change in the amount of time allocated to other activities. Along with this change in household time allocation, there

may be a change in own farm output which in turn affects household income.

If time spent working on FFW projects comes from leisure time, assuming zero opportunity cost for this time period, then the household enjoys a gain which leads to an increase in household income. In the study by Bezuneh (1985), it was hypothesized that a FFW participant's household net income will be higher than that of a non-participant's. The results indicated that participation in FFW increases one's income by 52 percent of which 23 percent was from direct employment in FFW projects and 29 percent from induced effects through labor reallocation and capital formation.

To theoretically explain female FFW participation, the household decision making model is utilized. Households are assumed to allocate their available resources so as to maximize a utility function. The major assumption made is that households are rational decision makers and thus are always striving to achieve the highest possible level of satisfaction. FFW programs in which participants are paid in food in exchange for providing labor services, may be looked at as a means to expand the opportunity set of participants in terms of time allocation. FFW expands the number of productive activities that households can choose from (Bezuneh, 1985).

Participants are drawn to engage in FFW when the utility of participating is greater than the opportunity cost of not participating. Households then maximize utility subject to a derived budget constraint. This budget constraint is based on the total cost of production and consumption given the total income from selling labor and farm products. The effect of FFW is hypothesized to be a substitute for both leisure and work

time at home. The time available for FFW depends on the person's employment status outside the home and the ownership of assets, land in particular. This suggests that a household's work time in FFW depends not only on the food wage rate but also on the amount of cultivated land that households own since the opportunity may exist to improve the productive capacity of the farm (Bezuneh, 1985). It is expected that landless participants will allocate more time to FFW than those who have land.

The model thus focuses on:

$$U = U(L, Q_i) \qquad [3.1]$$

where: U = utility;
L = consumption of leisure time;
Q_i = consumption of good *i*; and
$i = 1, \ldots, n$.

In the models of labor supply, the total amount of time available is divided into working[6] off-farm and into leisure time. Leisure is treated as a consumption good. The time used in household production is either not considered at all or a fixed portion of total time is assumed for work at home. Household decisions concerning labor supply and consumption are viewed as the result of maximization of the household utility function (U) subject to budget and time constraints (Ott, 1992):

[6]The term "work" is used for all activities comprising of time spent in the production of goods, either off-farm or at home.

$$\underset{L_i M_i}{\text{Max}}\ U(X,L) \qquad [3.2]$$

$$\text{s.t.}\quad T = L_i + M_i$$

$$pX = W_i + M_i + I$$

where: X=composite off-farm goods;[7]
L_i=leisure of individual *i*;
M_i=off-farm work time of individual *i;*
W_i=wage rate of individual *i*;
I=nonwage income;
p=price of composite off-farm good; and
T=amount of time available for each individual.

Applying such labor supply models to a multi-person household, such as the traditional household utility model depicted in equation [3.2], raises problems because the intrafamily division of work is not explained. Non-participation in the labor force of a family member results in these models only if his or her leisure time is highly valued in the household utility function. This is generally an unrealistic assumption. However, a high value for the non-off-farm time can be profitable for the entire family as a unit when non-off-farm time is not treated as leisure, which is of direct utility to the individual, but rather as time spent in household production. The concept of 'leisure' implicitly assumes a household production function. This is taken into account in models of time allocation.

Time allocation models basically assume that off-farm goods are not directly utility-bearing and that consumption requires additional time inputs (Becker 1965).

[7]Composite off-farm goods are a bundle of goods produced by a household.

Production of basic commodities is seen as the result of off-farm goods combined with housework time. Total time may be divided between off-farm work for earning income and work at home. Leisure is not dealt with explicitly, but is considered as a commodity that is produced only with housework time and without input of off-farm goods:

$$\underset{H_i, M_i}{\text{Max}}\ U(C) \qquad [3.3]$$

$$\text{s.t.}\quad C = Z(X, H_i)$$
$$T = M_i + H_i$$
$$pX = W_i M_i + I$$

where: Z = household production function;
H_i = time of individual *i* spent in household production;
C = total consumption; and

the other terms are as previously defined.

In such a model, comparative advantages in household or off-farm work result in full specialization of the spouses depending on the individual wage rates. The spouse that is more productive off-farm will specialize in off-farm work, leaving household work to the other spouse. Assuming that individual productivity is changed by the accumulation of human capital, comparative production advantages between the spouses will result in the long run even if they have identical resources in the beginning. Thus, specialization is optimal in any case. The intrafamily division of work is characterized by the fact that family members will specialize exclusively in one activity, be it spending time on work at home or off-farm (Becker 1985).

Extensions of these time allocation models (Graham and Green 1984, Gronau[8] 1986) suggest three different types of time utilization. The decision on time allocation includes a decision on how much time is to be spent for off-farm work, for work at home and for leisure. Leisure and time for household production are explicitly distinguished by the character of the goods produced. Leisure can be interpreted as a good in itself because it generates utility. The time spent in household production however, is a factor in producing household goods.

Traditional models of household decisions are often criticized because of their assumption of a common household utility function (Manser and Brown 1979). Up until now, it has not been possible to derive a conclusive foundation for the existence of a household utility function. It is doubtful if an intrafamily consensus always exists as postulated by Samuelson (1956). There is also no substantial empirical evidence supporting Becker's (1981) description of household behavior with a household utility function based on the behavior of one family member. Becker's results depend on the power of the family head to carry out his/her decisions. Thus, the existence of household utility functions depends on additional conditions.

There is considerable research in the area of household decision theory to discover the degree to which the attitudes and choices of individuals conform to what probability theory and statistics recommend (Kahneman, Slovic and Tversky 1982). Many of the

[8]Gronau assumes that it is the activity itself, that is, working in the market or at home, which generates direct utility.

decisions that are made are not made to further one's own personal interests directly, but rather involve various roles and groups to which one belongs to. Decisions are made for families, children, as well as for one's own sake.

The environment in which decisions are made is typically *dynamic*. The decision maker may know that it will change but have no idea of how or when the change will take place. To make the initial decision easier, von Winterfeldt and Edwards (1986) came up with the concept of decision trees by structuring the sequences of possible events and actions consequent to these events. Figure 3.1 presents a very simple decision tree. The framework of the problem is whether to participate in FFW activities. If one participates, then the benefits are receipt of food, increased employment opportunities, higher incomes and the ability to apply techniques learned from FFW participation to one's own farm. Since most FFW activities require manual labor, female participants may experience some barriers to participating in FFW activities such as health hazards from performing arduous tasks. Also, the quality of women's reproductive activities may decrease due to participating in FFW projects.

On the contrary, if one decides not to participate, then there is no sequence to follow on the decision tree. Non-participants would generally occupy themselves full time in either household or food production thus eliminating their opportunity cost of FFW participation. By engaging in other agricultural work, women can receive agricultural wages which in some cases may or may not be higher than FFW wages.

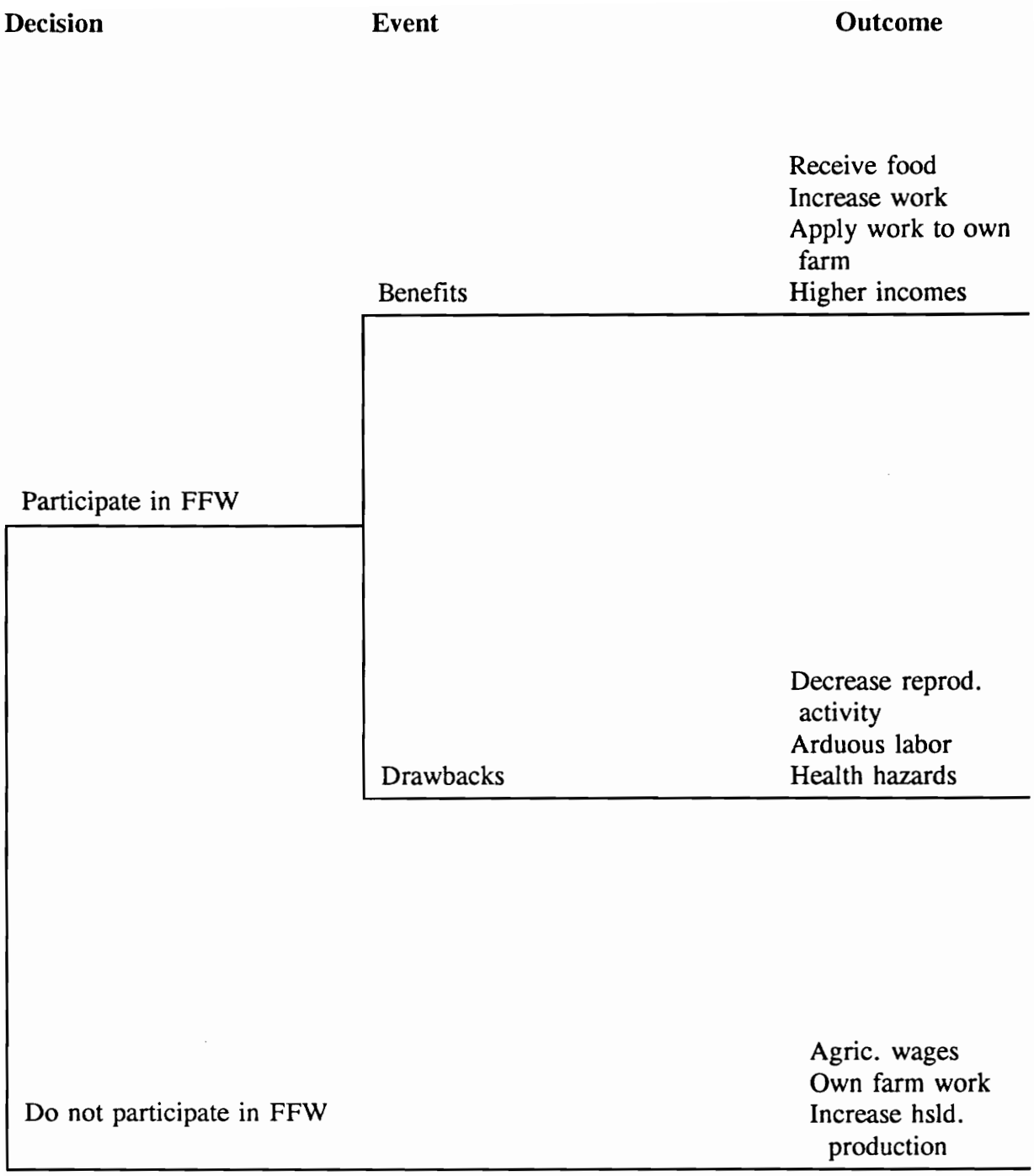

Figure 3.1 Decision Tree for FFW Participation

Source: von Winterfeldt and Edwards, 1986

III.2 FACTORS INFLUENCING FEMALE FFW PARTICIPATION

There are several factors that may influence a woman's participation in FFW programs. Income is one such factor. According to Webb, von Braun and Yohannes (1992), wealthier households can protect their food consumption better because they have more coping options than poorer households. Since poor people have less access to food, they are more likely to engage in projects that will provide them with food.

Webb, von Braun and Yohannes (1992) claim that public works are self-targeting and thus do not target the poor per se. In their study of famine coping patterns in Ethiopia, it was found that 90 percent of the population studied preferred receiving food to be consumed at home instead of wages. Only a few participants in FFW projects felt cash wage was more desirable. Research conducted by the Advocates for African Food Security (AAFS) in 1989 confirms that with the ever increasing costs of food, which diminishes the purchasing power of the people, people tend to participate more in FFW in order to obtain food in exchange for work. On the contrary, the Bezuneh (1985) study found that people prefer cash wages to FFW.

Education is an important factor that may affect one's participation in FFW projects. Education is a crucial factor for women to improve their chances of participating in wage employment (Collier and Horsnall 1989). Those with higher education have more knowledge and skills and thus may find alternative employment opportunities. Similarly, those with low educational levels are expected to participate more in FFW since their options of finding off-farm employment are limited.

Age is another factor that may affect participation in FFW programs. Studies from AAFS have shown that older farmers tend to dominate in these projects because young farmers leave the rural areas because they are more likely to be more educated and as a result more aware of their options. A household's livestock value could also influence women's participation in FFW. The more livestock a household has, the wealthier they are. Therefore, it is less likely that women from households with a lot of livestock will participate in FFW activities.

Poor health and sanitation may prevent participation in FFW as well. Staatz (1990) claims poor health is associated with lower levels of household food security for children and lactating women. As a household's size increases, one's nutritional status may decrease and hence poor health results. With poor health, one is inhibited from participating in FFW. However, the larger the household size, the greater the need to engage in such programs since there are more mouths to feed.

Staatz (1990) also finds a correlation between products that women sell from their own individual farms and children's health. The more of these products that are sold, the higher the chances of a child's health deteriorating. In this manner, women will neither be able to receive help from their children at home nor through their off-farm employment thus decreasing their participation in FFW. A case study by Leslie (1988) found that women's work in agriculture decreases given higher income which was also correlated with larger farm size. When an increased workload results in increased returns to women's labor, this may translate into improved household and child welfare.

Empirical evidence from time allocation studies reveal that women's time is more likely to be spent in reproductive activities than is men's time. In contrast, both women and men engage in all the other categories of time use. Men's time however, is more likely to be spent in off-farm work than women's time thus making women's labor less mobile (Boserup 1970, McGuire and Popkin 1990).

While landowners benefit most from direct income effects of increasing agricultural productivity, landless and food deficit small farmers benefit most from the indirect effects of increasing agricultural productivity through off-farm employment generation (Hossain 1988). In a FFW study of some Bangladesh villages, Kumar and Chowdhury (1985) found that there was more employment available for landless farmers than for those who own land thus increasing the likelihood of landless farmers from participating in such projects.

In the past, poor countries in general have used FFW programs but measured on a per capita income basis, they are not the poorest of the developing countries. This may be due to an interaction of several factors. Many of the poorest countries, the majority of which are in sub-Saharan Africa, have very small populations relative to agricultural area. They often have a large nomadic population making it difficult to implement public works projects. The very young, very old, very ill, the malnourished, and frequently women, are the groups that are quite difficult to reach directly through such programs (Sen, 1993). Public works are generally physically demanding thus eliminating persons incapable of arduous physical labor.

III.3 SCOPE OF THE ANALYSIS

The methods used in this study for determining a woman's participation in FFW do not explicitly capture the impact nor the benefits accrued from such participation. Although important to a comprehensive analysis, the direct impacts of participation are not considered in this study. Nevertheless, assuming that women who participate in FFW receive higher incomes and an increase in food consumption is important in terms of their FFW participation objectives. Any number of economic and non-economic factors can influence a farmer's decision to participate in FFW, as noted in the previous section, but a different set of factors may influence the types of FFW activities that one can choose to engage in.

Physical factors, such as the land area and the type of soil, dictate what FFW activities would be most effective for a given area. Also, the crops grown and the different types of fertilizers used influence the efficacy of the program. The usage of equipment could also determine how effective such a program will be. Although a complete analysis of FFW participation should include such considerations, this study focuses on determining the factors that influence women to participate in FFW activities, and does not include an analysis of the factors which influence specific FFW activities that are available nor the benefits of participating in FFW.

CHAPTER IV

EMPIRICAL MODELS AND METHODS

IV.1 INTRODUCTION

Econometric models estimate the relationship among the variables which can be used to predict behavior conditional on a set of explanatory variables. The variables used in such models can be classified as continuous or discrete. A continuous variable is one which can take any value on a line, such as the yield of a crop or the amount of output sold. A discrete variable is one which can take only certain values on a line, such as the number of individuals in a family or the number of cattle on a farm (Maddala, 1983). There are certain variables, however, which can neither be classified as continuous nor discrete. For example, if one is interested in studying the effect of a farmer's participation in government programs on the output of certain crops, the independent variable is whether or not a farmer participates in the program. This type of variable is called a *qualitative choice variable* (Maddala, 1983). When there are qualitative variables among the independent set, they are included as dummy variables. The estimated function from a logit qualitative choice econometric model allows probabilities to be attached to the predictions.

For this study, we are interested in determining the factors contributing to women's participation in FFW programs. The dependent variable, then is whether or not a woman participates. This type of model is called a *binary choice model* because a choice has to be made between two alternatives (Maddala, 1983). This type of model seems appropriate for a quantitative study of the factors contributing to FFW participation. A binary choice model estimated from the sample mean can then be applied to the population from which it was drawn to predict female FFW participation in Southern Shoa. This will not predict participation rates with perfect accuracy. Therefore, a more reasonable application of the estimated equation is to predict the likelihood of women participating in FFW projects.

In the following sections, three types of binary choice models will be introduced and a suitable model for analyzing women's decision to participate in FFW programs shall be provided. The properties and assumptions of the chosen model will be defined and a conceptual framework of a FFW participation model will be presented.

IV.2 LINEAR PROBABILITY MODEL

The linear probability model can be expressed as (Aldrich, 1984):

$$Y_i=\beta_0+\beta_iX_i+\varepsilon_i \qquad [4.1]$$

where:

Y_i=binary choice variable taking on value of 0 or 1;
X_i=row containing p explanatory variables;
β_0=intercept constant;
β_i=px1 vector of parameter coefficients; and
ε_i=error term.

The assumption that a probability model is linear in the independent variables is unrealistic in most cases. Further, if a model is incorrectly specified as linear, then the statistical properties derived under the linearity assumption will not hold. The problem with the linear probability model specification is that the predicted values can fall outside the interval (0,1). One way of approaching this problem is to transform P_i, the probability of the *i*th individual taking part in an event, so that the transformed values of the predictions will fall within the range (0,1). There are two possible probability transformations that are commonly chosen to represent the (0,1) range. These are the logistic and the normal probability models. The former is also known as the logit model and the latter as the probit model (Gujarati, 1988).

In the probit probability model, a new variable Z_i is defined as (Aldrich, 1984):

$$Z_i=\beta_0+\beta_iX_i. \qquad [4.2]$$

The variable Z_i is only arbitrary and the prediction of the likelihood of women participating in FFW projects is based on whether the variable gets a high value or a low value (Zuhair, 1986). Estimates obtained from the probit model are normalized to equal

1. To produce a closer approximation between the logistic distribution[9] and the standard normal distribution, the logit model's coefficients must be multiplied by $(3/\pi)^{1/2}$ or .625 to get comparable estimates obtained from the probit model (Amemiya, 1981). The probit model is criticized because it lacks theoretical justification, therefore, this study will use the logit model to analyze women's participation in FFW projects.

IV.3 THE LOGIT MODEL

The logistic cumulative distribution function is:

$$F(Z_i)=e^{Zi}/(1+e^{Zi}), \qquad [4.3]$$

where e is the base of natural logarithms.

With the logit model an expression for P_i that can take on any value from 0 to 1 is developed. It is near 0 when Z_i is near $-\infty$, and it goes to 1 as Z_i goes to $+\infty$ (Aldrich, 1984). In the logit model, P_i is expressed as a function of $\beta_0+\beta_iX_i$, which is then substituted for Z_i. The transformed logit model thus becomes:

$$P_i=F(Z_i)=1/(1+e^{-Zi}), \qquad [4.4]$$

which can be manipulated as:

$$e^{Zi}=P_i/(1-P_i). \qquad [4.5]$$

[9]The logistic distribution has a variation of $\pi^2/3$.

Taking the natural logarithm of both sides results in:

$$Z_i = \ln[P_i/(1-P_i)]. \qquad [4.6]$$

Thus, the general form of the logit model is:

$$\ln(P_i/1-P_i) = Z_i = \beta_0 + \beta_i X_i, \qquad [4.7]$$

where the dependent variable is the logarithm of the ratio of the probability that the decision to participate in an event will occur to the probability that the decision to participate in an event will not occur. Thus, the dependent variable can be interpreted as the logarithm of the odds that a particular decision will be made. The assumptions of the logit model are given in Table 4.1.

The first assumption demonstrates that the dependent variable Y_i has to be binary taking on but two values, 0 and 1. The outcomes on Y_i are assumed to be mutually exclusive and exhaustive. The question of interest hinges on the value of the parameter P, the probability that Y_i equals one given X_i, is a logistic distribution function as stated in the second assumption. Assumption three states that Y_i is dependent on X_i. That is, the exogenous variables are assumed to account for the variation in P. The observations on Y_i are required to be statistically independent of each other so as to rule out serial correlation. The fourth assumption implies that each X_i must have some variation across

Table 4.1 Assumptions of the Logit Model

(i) $Y_i \in \{0,1\}, i=1,\ldots,n$

(ii) $P(Y_i=1 \mid X_i)=e^{Zi}/(1+e^{Zi})$

(iii) $Y_1, Y_2,\ldots,Y_n$ are statistically independent

(iv) No exact or near linear dependencies exist among the X_i's

Source: Aldrich, 1984

the total number of observations and that no two or more X_i's can be perfectly correlated. If near or exact linear dependencies exist, then problems of computational imprecision, unstable estimates and large sampling error may occur. That is, the logit model can suffer from problems of multicollinearity (Aldrich, 1984).

There are several advantages as well as disadvantages to using the logit model. One major constraint is that the logit model does not take into account any benefits or impacts attained from FFW participation. The long run profitability of participating in such an event is not considered. Only the short term goal of FFW is considered. Logit analysis considers how extensively an event is being carried out as well as simply whether or not the event is taking place. At the same time, using logit is superior to using the ordinary least squares (OLS) estimation technique which is used to estimate ordinary regression models, because people who are not involved in FFW can also be included in the study sample without sacrificing desirable properties of the model's parameter estimates (Norris, 1985).

The maximum likelihood method (MLE), which shall be described later in this chapter, is also required for estimating the logit model. If the independent variables are normally distributed, then the maximum likelihood estimation (MLE) is consistent. This would occur in the case in which the independent variables are dummy variables and thus the assumption of normality is violated. Logit models also suffer the problem of multicollinearity where the variables dealt with are subject to two or more relations (Maddala, 1992).

The logit model is a closed form expression, meaning it does not involve integrals explicitly (Aldrich, 1984). Not all distributions permit such a closed form expression. From the logit likelihood function, the parameter coefficients and the standard errors can be estimated separately providing better estimates. The logit model preserves as many of the great strengths of the linear probability model as possible, including the ease with which useful and interesting inferences can be drawn from the data.

The method of Maximum Likelihood Estimation (MLE) (assuming normality of the error terms) consists of estimating the unknown parameters in such a manner that the probability of observing the given Y_i is as high as possible. The maximum likelihood method of estimating coefficients is appropriate for smaller samples whereas the ordinary least squares (OLS) procedure is appropriate for larger samples.

In estimating with maximum likelihood, the coefficients are the same as that of the OLS estimation technique. However, the variances (σ^2) differ (Aldrich, 1984). But if the sample size is increased, the estimated variances becomes unbiased and thus equal the OLS estimate of σ^2. OLS tries to find parameter estimates that make the predicted values of Y_i as close as possible to the actually observed values of Y_i. In OLS, closeness is measured by the sum of squared differences between observed and predicted values of Y_i.

The principal of MLE is to choose an estimate of β_i that would make the likelihood of having observed this particular Y_i as large as possible. Thus, the conceptual difference between OLS and MLE is that OLS is concerned with picking

parameter estimates that yield the smallest sum of squared errors in the fit between the model and data, while MLE is concerned with picking parameter estimates that imply the highest probability or likelihood of having obtained the observed sample Y_i.

The properties of MLE are as follows:

(i) unbiasedness-estimates are centered around the true values on average;

(ii) efficiency-no other unbiased estimator has lower sampling variance; and

(iii) normality-how to perform hypothesis tests and draw other inferences is known.

Exact results cannot be obtained from the logit model. However, the asymptotic (large sample) property seems to hold reasonably well for this model. A minor drawback to MLE is that the likelihood equations for logit are nonlinear in the parameters to be estimated, thus algebraic solutions are not obtainable. Rather, approximations by standard iterative algorithms are used.

To perform calculations using the logit model, the dependent variable must first be defined as:

$Y=1$ if participate in FFW; and

$Y=0$ if do not participate in FFW.

The likelihood function can be written as:

$$L = \prod_{i=1}^{n} P_i^{Yi} (1-P_i)^{(1-Yi)} \qquad [4.8]$$

where: P_i is the probability of participating in FFW; and
the other variables are as previously defined.

To accomplish the MLE, the log-likelihood estimation must be developed. The logarithms of the equation above are taken to give:

$$\ln(L) = \sum_{i=1}^{n} \ln(P_i) + \sum_{i=1}^{n} \ln(1-P_i) \qquad [4.9]$$

By substituting [4.8] in equation [4.9] the first order conditions for Max ln L can be derived. These equations are non-linear. Therefore, the scoring method (also known as the Newton-Raphson method) must be used to solve the equations. The LIMDEP program performs these computations giving us the estimated parameters that will enable us to test our hypotheses. A printout of the LIMDEP program is given in Appendix A. Other than the signs of the coefficients, the parameters estimated by MLE are not of particular interest. Rather, the effect of the estimated parameters on the probability of FFW participation is what needs to be calculated.

Logit analysis can also be used to determine changes in the probability of the dependent variable due to changes in the explanatory variables. Using the relationship $\Delta \ln X_i \approx \Delta X_i / X_i$, the expression $\Delta \ln[P_i/(1-P_i)]$ can be written as (Zuhair, 1986):

$$\Delta \ln P_i/1-P_i \approx [1/P_i + 1/1-P_i]\Delta P_i = 1/P_i(1-P_i)\Delta P_i \qquad [4.10]$$

This equation allows us to determine the probability change in the dependent variable due to a change in an explanatory variable. A single value cannot be assigned to express the impact of a change in an explanatory variable on the probability. However, a reasonable point at which to estimate the change in the probability of female participation in FFW due to changes in the explanatory variables is the sample mean.

To calculate the change in probabilities, the parameter estimates are multiplied by the means of the explanatory variables. Then their sum is taken and raised to the base of the natural logarithms (e^{XiBi}). One is added to this value to give us the ratio $e^{XiBi}/1+e^{XiBi}$, also known as the logistic cumulative distribution function. The parameter estimates are multiplied by this ratio giving us the change in probability estimates of the independent variables. The calculations of the changes in probability estimates are given in Appendix B.

IV.3.1 Conceptual Model for FFW

The logit model will be used to predict effects of changes in one of the independent variables on the probability of an event taking place.

The general model is:

Y_i=f(age, education, occupation, marital status, income, wages, etc.)

where: Y_i is the dependent variable representing FFW participation by women and the independent variables are the socio-economic factors.

Given the variables that I have access to, the model specification is as follows: (The variables are defined in Table 4.2)

$$\ln(P_i/(1-P_i)) = \beta_0 + \beta_1 AGE + \beta_2 EDUC + \beta_3 MARSTDUM1 + \beta_4 MARSTDUM2 + \beta_5 MARSTDUM3 + \beta_6 MARSTDUM4 + \beta_7 REPSTDUM1 + \beta_8 REPSTDUM2 + \beta_9 REPSTDUM3 + \beta_{10} REPSTDUM4 + \beta_{11} REPSTDUM5 + \beta_{12} OCCUPDUM1 + \beta_{13} OCCUPDUM2 + \beta_{14} OCCUPDUM3 + \beta_{15} OCCUPDUM4 + \beta_{16} OCCUPDUM5 + \beta_{17} OCCUP2 + \beta_{18} FMSIZE + \beta_{19} CHILDLAB + \beta_{20} LANDTOTH + \beta_{21} TOTPRD + \beta_{22} TOTLSD + \beta_{23} TLSVAL + \beta_{24} TNFINC + \beta_{25} TNFEXP + \beta_{26} DAYSWORK + \beta_{27} DISTANCE + \beta_{28} TOTWAGE1 + \beta_{29} TOTWAGE2 + \varepsilon_i$$

Table 4.2 Definition of Variables Used in Logit Model

AGE-Age in years of individual

EDUC-Education level in years of individual

MARST-Marital Status of individual
- MARSTDUM1=1 if Married(Monogamous), 0 otherwise[a]
- MARSTDUM2=1 if Married(Polygamous), 0 otherwise
- MARSTDUM3=1 if Widowed/Divorced, 0 otherwise
- MARSTDUM4=1 if Single, 0 otherwise

REPST-Reproductive Status of individual
- REPSTDUM1=1 if Not applicable, 0 otherwise[a]
- REPSTDUM2=1 if Lactating, 0 otherwise
- REPSTDUM3=1 if Pregnant, 0 otherwise
- REPSTDUM4=1 if Not Pregnant/Not Lactating, 0 otherwise
- REPSTDUM5=1 if Pregnant/Lactating, 0 otherwise

OCCUP-Primary Occupation of individual
- OCCUPDUM1=1 if No occupation, 0 otherwise
- OCCUPDUM2=1 if Farmer, 0 otherwise
- OCCUPDUM3=1 if Housekeeper, 0 otherwise[a]
- OCCUPDUM4=1 if Student, 0 otherwise
- OCCUPDUM5=1 if Herder, 0 otherwise

OCCUP2-Secondary Occupation of individual
- OCCUP2DUM1=1 if No occupation, 0 otherwise
- OCCUP2DUM2=1 if Farmer, 0 otherwise
- OCCUP2DUM3=1 if Housekeeper, 0 otherwise[a]
- OCCUP2DUM4=1 if Student, 0 otherwise
- OCCUP2DUM5=1 if Herder, 0 otherwise

FMSIZE-Family size (number of individuals)

CHILDLAB-Child agricultural labor days (13 yrs and under)

[a]These explanatory dummy variables were used as reference points.

Table 4.2 Definition of Variables Used in Logit Model continued

LANDTOTH-Land owned in hectares per household

TOTPRD-Amount of total output produced in kgs

TOTSLD-Amount of total output sold in kgs

TLSVAL-Total livestock value per household

TNFINC-Total non-farm income per household

TNFEXP-Total non-food expenditure per household

DAYSWORK-Number of days worked per individual

DISTANCE-Distance of project away from home in minutes

TOTWAGE1-Wages from FFW for women participants

TOTWAGE2-Wages from agricultural work (Non-FFW)

IV.4 HYPOTHESES

A number of specific factors are hypothesized to significantly influence women's participation in FFW projects. Characteristics of participants which are expected to have a significant impact include their average household income, whether one holds an off-farm job, their household responsibilities, whether one expects the aid of a child and some demographic factors.

It is hypothesized that one's income will be inversely related to one's participation in FFW programs, with rural women with lower income having the tendency to participate more than rural women with higher income. A woman who expects her children to take part in FFW projects is likely to place more importance on other household activities hence decreasing her likelihood of participating in FFW.

For those who hold off-farm employment, they are expected to participate less in FFW because they may have less time to devote to the program and may be less aware of the benefits that can be achieved. Also, other off-farm employment may be more stable and it may pay more, hence reducing the likelihood that women participate in FFW activities. Women who must attend to their many household responsibilities generally face a constraint in time, thus not being able to participate regularly in FFW.

Several other characteristics are also hypothesized to influence a woman's decision to participate in FFW. A woman with a large family is expected to participate more in FFW, since larger family size is associated with the need for higher income to feed and

maintain the household. Also, households with large family sizes are likely to participate more in FFW projects because of the availability of family labor.

For those who farming is their primary occupation, it is hypothesized that they will tend to engage more in agricultural programs such as FFW than those who have an off farm source of income. A negative relationship between the participant's age and the likelihood of participating in FFW is also expected. Younger women may view participation as being profitable and may be more willing to accept any risk that may be associated with such participation.

Higher education levels should be associated less with participation in FFW programs. They may have a better chance to find alternative employment that will earn them higher incomes. Therefore, it is hypothesized that those with less education will more likely participate in FFW projects than those with higher education.

A woman's participation in FFW may be influenced by her marital and reproductive status. It is hypothesized that widowed/divorced women will more likely participate in FFW programs than married or single women because women heads of households need to engage in income generating activities. Women who are not lactating and are not pregnant are also hypothesized to participate more in FFW since they are more mobile and more able to engage in activities such as upgrading roads, constructing dams and working on irrigation projects.

Wages are also an important determinant of whether women participate in FFW projects. The greater the wages, the more likely women will engage in these activities.

On the contrary, the greater the wages from agricultural work, the less likely it is that women will participate in FFW activities. Women will resort to other agricultural work such as weeding, tilling the land, and ploughing if these activities can secure higher wages.

Female FFW participation may also be influenced by the number of livestock per household and the amount of land area per household. It is hypothesized that the more livestock a household has, the less likely it is that a woman from that household will engage in FFW programs. Similarly, the more land area a household has, the less likely women from that household will participate in FFW. The total non-food expenditures incurred by a household may have a significant impact on female FFW participation. Non-food expenditures, which are also a good proxy for income, are usually associated with greater wealth. Therefore, the more non-food expenditures incurred by a household the less likely women from that household will participate in FFW activities.

The distance of the FFW sites could be a contributing factor to female FFW participation. The farther away the site, the less likely women will participate in FFW activities. The constraint here is not a physical one, but rather a lack of time and also cultural norms which may bar women from travelling long distances. Also, the more permanent the FFW project is, the more likely women will participate. Total on farm production could also have an influence on FFW participation. If household agricultural production is high, then female participation in FFW is likely to be less since women can obtain higher incomes from the sale of their agricultural produce.

In summary, the following hypotheses will be tested:

1)The lower a household's income, the greater the likelihood that women will participate in FFW programs.

2)Women who hold off farm employment are expected to participate less in FFW activities.

3)Households with larger families are expected to participate more in FFW programs.

4)Younger women are expected to participate more in FFW activities.

5)Women with a higher education are expected to participate less in FFW activities.

6)Female heads of households are expected to participate more in FFW programs.

7)The greater the FFW earnings, the more likely it is that women will participate in FFW activities.

8)The more livestock and land a household has, the less likely it is that a woman from that household will participate in FFW activities.

9)The greater the non-food expenditures incurred by a household, the less likely women from that household will participate in FFW activities.

10)The greater the total household on farm production, the less likely it is that women of that household will participate in FFW activities.

CHAPTER V

ANALYSIS AND RESULTS

V.1 DATA ANALYSIS

In this study, only the female population in the three *awrajas* was taken into account. There were a total of 651[10] females, 185 participated in FFW and 466 did not participate in FFW activities. Table 5.1 shows a breakdown by categories of the female sample. The age range of 14 to 65 years made up 27.4 percent of the female sample who participated in FFW with 1.3 percent of the FFW participants being less than 13 years old. More than 85 percent of the female sample had no education. Only 3 percent of the women in FFW completed up to six years of education and less than one percent had 7-12 years of education. There were no statistical significant differences between FFW and non-FFW participants in the age and educational groups. A frequency distribution of the explanatory variables is given in Appendix C.

A little less than half (48 percent) of the women claimed having no major occupation. These were probably women who engage in some type of work at home but do not consider themselves as having an occupation. The majority of the women were single consisting of 19.2 percent of those that participated in FFW and 49.1 percent of

[10]There were 655 observations with 4 missing values.

Table 5.1 Characteristics of the Female Sample

Category	FFW	Non-FFW
Total female population	185 (28.4)[11]	466 (71.6)
Age[12]		
Between 14-65 years	145 (27.4)	365 (69.0)
Less than 13 years	7 (1.3)	12 (2.2)
Education level[13]		
No education	155 (24.4)	393 (61.8)
1-6 years	20 (3.0)	52 (8.0)
7-12 years	5 (0.07)	10 (1.5)
Major occupation		
No occupation[14]	93 (14.6)	217 (0.03)
Farmer	22 (3.4)	75 (11.8)
Housekeeper	41 (6.4)	103 (16.2)
Herder	13 (2.0)	33 (5.1)
Student	12 (1.8)	26 (4.0)
Marital status		
Married/monogamous	41 (6.4)	102 (16.0)
Married/polygamous	11 (1.7)	33 (5.1)
Widowed/divorced	4 (0.06)	10 (1.5)
Single	122 (19.2)	312 (49.1)
Reproductive status		
Not applicable[15]	140 (22.0)	374 (58.8)
Lactating	14 (2.2)	25 (3.9)
Pregnant	3 (0.05)	17 (2.6)
Not lactating/Not pregnant	19 (2.9)	37 (5.8)
Lactating/Pregnant	4 (0.06)	2 (0.03)

[11]Percentages by category are in parentheses.

[12]$t=-0.21;p<.8$

[13]$t=-0.29;p<.7$

[14]These are probably women who engaged in housework which they did not consider a major occupation.

[15]These are either young women who never had any children or older women with no children who are past the child bearing age.

those that did not. A possible explanation for this large percentage of single women is that the majority of the Ethiopian men were drafted during the 30 year civil war. Also, the Ethiopian government had attempted to promote equal rights for single women allowing them to have access to land and other assets. Women, then could register by themselves and hence support themselves. They could claim to be single in order to get such advantages, when in reality they are married (Pankhurst, 1992).

The married/monogamous category of FFW participants is 6.4 percent and the married/polygamous category of female FFW participants makes up a mere 1.7 percent of the population. As for one's reproductive status, the "not applicable" response dominates in number with 22 percent of women in FFW and 58.8 percent of those not in FFW. Here, most of the respondents were either young and never had any children or were past their child bearing age.

As presented in Table 5.2, there is a greater percentage of FFW participants that have access to between 2.1 and 3.0 hectares of cultivable land than non-participants. This was statistically significant at the 0.1 level. This land area range is an average amount for rural households in this area providing for self sufficiency. Table 5.3 demonstrates that the majority of women in both categories report some non-farm income for the 15 month period. There is no statistically significant difference between FFW and non-FFW participants in the level of non-farm income.

Table 5.2 Total Land Area Owned by Households

Land Owned (in ha)	FFW participants	Non-FFW participants	Total
.10-.40	14 (7.5)	39 (8.4)	53
.50-.90	42 (22.7)	100 (21.5)	142
1.0-2.0	62 (33.5)	172 (36.9)	234
2.1-3.0	37 (20.0)	58 (12.4)	95
3.1-4.0	11 (5.9)	19 (4.0)	30
> 4.0	11 (5.9)	18 (3.9)	29

$\chi^2 = 6.7657, d.f. = 5, p < .1$

Note:There were 185 FFW participants and 466 non-participants.
(Percentages by participation category are in parentheses)

Table 5.3 Total 15 Month Non-farm Income of Female Sample

Non-farm Income (in Birr[16])	FFW participants	Non-FFW participants	Total
0	53 (28.6)	120 (25.7)	173
1-100	76 (41.0)	226 (48.5)	302
101-200	32(17.3)	67 (14.4)	99
201-300	11 (5.9)	17 (3.6)	28
301-400	4 (2.2)	10 (2.1)	14
> 400	8(4.3)	22 (4.7)	30

$\chi^2=4.394$,d.f. $=5$,$p<.5$

Note:There were 185 FFW participants and 466 non-participants.
(Percentages by participation category are in parentheses)

[16]$1U.S. =2.25Birr

Table 5.4 depicts the total non-food expenditures of households within our sample. This variable is highly statistically significant with a 99 percent probability ($p < .01$) of influencing female FFW participation. The majority of households had non-food expenditures of 800 Birr or less. Table 5.5 shows the total output sold from agricultural production from women in households of the study sample. Again, there is a high statiscally significant difference at the .01 level between the distribution of total output sold between FFW and non-FFW participants.

Table 5.6 gives a breakdown of the total livestock value of households. There is a slight statistically significant difference at the .10 level between the total livestock value of households between FFW and non-FFW participants. Surprisingly, though, 209 households owned no livestock. The large chi-square value of 16.6902 implies that there is a large difference in the frequency of household livestock value between FFW and non-FFW participants.

In Tables 5.1 through 5.6, the results of the chi-square tests show some significant differences between the women who participate in FFW and those that do not. From these tables we can deduce that women in this region have low income levels and less land area per household as well as less livestock value per household.

The distance of the FFW site to women's homes, second occupation, total output produced from agricultural production, and the number of days worked variables could not be included in the analysis because they were highly correlated.

Table 5.4 Total Non-food Expenditures of Households

Non-food Expenditures (in Birr[17])	FFW Participants	Non-FFW Participants	Total
< 100	13 (7.0)	86 (18.4)	99
100-400	91 (49.2)	213 (45.7)	304
401-800	45 (24.3)	104 (22.3)	149
801-1200	21 (11.3)	21 (4.5)	42
1201-1600	6 (3.2)	9 (1.9)	15
1601-2000	1 (0.5)	10 (2.1)	11
> 2000	8 (4.3)	15 (3.2)	23

$\chi^2 = 12.592, d.f. = 6, p < .01$

Note:There were 185 FFW participants and 466 non-participants.
(Percentages by participation category are in parentheses)

[17]$1U.S. = 2.25Birr

Table 5.5 Total Output Sold from Agricultural Production

Output Sold (in kgs)	FFW Participants	Non-FFW Participants	Total
0	164 (88.6)	374 (80.2)	538
10-50	11 (5.9)	36 (7.7)	47
51-100	3 (1.6)	18 (3.8)	21
101-200	5 (2.7)	15 (3.2)	20
201-300	1 (0.5)	9 (1.9)	10
> 300	1 (0.5)	14 (3.0)	15

$\chi^2 = 9.041, d.f. = 5, p < .01$

Note: There were 185 FFW participants and 466 non-participants.
(Percentages by participation category are in parentheses)

Table 5.6 Total Livestock Value of Households

Livestock Value (in Birr[18])	FFW Participants	Non-FFW Participants	Total
0	48 (25.9)	161 (34.5)	209
1-100	54 (29.2)	104 (22.3)	158
101-200	27 (14.5)	79 (16.9)	106
201-300	22 (11.9)	52 (11.2)	74
301-400	15 (8.1)	18 (3.8)	33
401-500	4 (2.2)	15 (3.2)	19
501-600	6 (3.2)	4 (0.8)	10
> 600	6 (3.2)	21 (4.5)	27

$\chi^2 = 16.6902, d.f = 7, p < .1$

Note:There were 185 FFW participants and 466 non-participants. (Percentages by participation category are in parentheses)

[18]$1U.S. = 2.25Birr

In addition, there were too many missing values in the data set for the second occupation and the distance variables to be considered, thus not allowing for enough variation for the study sample. The total output produced and the number of days worked variables were also highly collinear.

Logit analysis was employed using the remaining explanatory variables. The model used for determining the probability of female FFW participation is shown below.

The estimated logit model is as follows:

$$\ln(P_i/1-P_i)=\beta_0 + \beta_1 AGE + \beta_2 EDUC + \beta_3 MARSTDUM2 + \beta_4 MARSTDUM3 + \beta_5 MARSTDUM4 + \beta_6 REPSTDUM2 + \beta_7 REPSTDUM3 + \beta_8 REPSTDUM4 + \beta_9 REPSTDUM5 + \beta_{10} OCCUPDUM1 + \beta_{11} OCCUPDUM2 + \beta_{12} OCCUPDUM4 + \beta_{13} OCCUPDUM5 + \beta_{14} FMSIZE + \beta_{15} CHILDLAB + \beta_{16} LANDTOTH + \beta_{17} TOTLSD + \beta_{18} TLSVAL + \beta_{19} TNFINC + \beta_{20} TNFEXP + \beta_{21} TOTWAGE1 + \beta_{22} TOTWAGE2 + \varepsilon_i \quad [5.2]$$

where:
P_i=probability of participating in FFW;
$1-P_i$=probability of not participating in FFW;
β_0=intercept constant;
β_i=parameter coefficients;
ε_i=error term; and
the variables are defined in Table 4.2.

Table 5.7 presents a descriptive analysis of the variables used in the estimated model. The average age was 28 with the youngest female being 11 years old and the oldest 65. The mean education level was less than one year. The majority of the women farmers were in the not applicable category for their reproductive status meaning that they had never had any children. The mean child agricultural labor days was 22 which is not much considering this is for the 15 month period in which the project was conducted.

V.2 ESTIMATION AND RESULTS

Table 5.8 shows the results of the logit model estimation. The results indicate that MARSTDUM2 is significant at the .10 level. REPSTDUM4 and OCCUPDUM1 are significant at the .15 and .18 levels of significance. They are not statistically significant but they are having some effect in the model. The positive coefficient on OCCUPDUM1 suggests that a larger proportion of women with no occupation are more likely to participate in FFW activities. The results support the hypothesis that women who have no real occupation or who are not gainfully employed, are more likely to participate in FFW activities since they view FFW as a source of employment. The negative coefficient on MARSTDUM2 suggests that women who are married in a polygamous

household are less likely to participate in FFW programs than those who are married in a monogamous household. Polygamy is associated with being better off financially, thus reducing the likelihood that married/polygamous women participate in FFW. The positive coefficient on REPSTDUM4 suggests that women who are not pregnant and not lactating are more likely to participate in FFW programs. This supports the hypothesis that women who are neither pregnant nor lactating are more able to engage in labor intensive activities hence increasing their likelihood of participating in FFW. The large coefficient suggests that this variable has a large impact on influencing women's participation in FFW programs.

Family size, total household non-food expenditures, women's wages from FFW and women's wages from agricultural work have positive and significant coefficients. The positive coefficient on family size suggests that women with larger families are more likely to participate in FFW. As for the total amount of non-food expenditures[19] incurred by households, the results show that the more non-food items purchased, the more likely women are to participate in FFW activities. A possible explanation for this is that more non-food expenditures are incurred due to large family sizes. The larger the family size, the greater the need to participate in FFW programs.

[19]Non-food expenditures consist of fuel for cooking, cooking pots, fertilizers, tools for ploughing, clothing, shoes and so forth.

Table 5.7 Descriptive Statistics of the Explanatory Variables

Variables	Mean	Std.Dev.[e]	Min[f]	Max[g]
Age	28.615	10.962	11	65
Education	0.615	1.774	0	12
Marital Status	3.922	1.683	1	5
Reproductive Status	0.508	1.200	0	4
Occupation	1.206	1.534	0	8
Family size	7.063	3.008	1	22
Child labor[a]	22.147	39.333	0	319
Land owned[b]	1.856	1.621	0.33	12.54
Amount of output sold[c]	36.394	125.00	0	1200
Total livestock value	242.39	476.12	0	4769
Total non-farm income[d]	89.731	145.02	0	1420
Total non-food expenditure[d]	495.22	724.41	0	8196
Wages from FFW[d]	48.215	63.003	3	1000
Wages from agricultural work[d]	30.971	60.225	3	1000

[a]measured in days for the 15 month period in which data was collected.
[b]measured in hectares per household.
[c]output sold from agricultural production measured in kgs.
[d]measured in Birr (Ethiopian currency); in 1990-91 $1U.S. = 2.25Birr.

[e]Standard Deviation.
[f]Minimum Value.
[g]Maximum Value.

Table 5.8. Results of the Logit Estimation Model

Independent Variables	Estimated Parameters	t-values
Constant	-2.44700	-2.348***
Age	-0.00249	-0.210
Education	-0.02718	-0.299
Marital Status DUMMY2	-0.77396	-1.330*
Marital Status DUMMY3	-0.00135	-0.002
Marital Status DUMMY4	0.02964	0.037
Reprod. Status DUMMY2	0.93554	1.012
Reprod. Status DUMMY3	0.99812	0.888
Reprod. Status DUMMY4	2.17370	1.509[a]
Reprod. Status DUMMY5	0.74293	0.876
Occupation DUMMY1	0.63829	1.431[b]
Occupation DUMMY2	0.55045	0.672
Occupation DUMMY4	0.18976	0.260
Occupation DUMMY5	0.24793	0.415
Family size	0.09637	1.917**
Child labor	-0.00114	-0.387
Land owned	-0.01147	-0.129
Amount of output sold	-0.00823	-3.089***
Total livestock value	-0.00016	-0.632
Total non-farm income	0.00073	0.758
Total non-food expenditure	0.00051	1.758**
Wages from FFW	0.00577	1.732*
Wages from agricultural work	0.01194	3.478***

Test statistics:

Log of likelihood function at its maximum (ln L_{max}):	-206.6479
Chi-squared (22 degrees of freedom):	56.2862
Significance level:	0.77E-04
Number of correct predictions:	281
Percentage of correct predictions:	79

[a] Significant at the 0.15 level
[b] Significant at the 0.18 level

*** Significant at the 0.01 level
** Significant at the 0.05 level
* Significant at the 0.10 level

The higher the total wages from FFW, the greater the likelihood that women will be attracted to these programs. Higher total wages may be related to women having assurance of more work available from FFW, thus making them more willing to accept risks associated with other activities that they have to forgo to participate in the FFW program. Interestingly, the results show that the higher the total wages from agricultural work the more likely it is that women will participate in FFW activities. This could be explained by the fact that the FFW programs were available to everyone in the districts and lower income people did not have sole access to the FFW programs. Also, with higher total wages from agricultural work, FFW participation may represent less of a risk, in terms of forgone opportunities. According to the Kumar (1993) study, the highest FFW participation was during the preharvest period when agricultural activities and therefore, and food available at the household level would be minimal.

The total amount of output sold from agricultural production has a negative and significant coefficient. Agricultural production was expected to have an influence on a woman's participation in FFW. The less output sold from agricultural production, the greater the likelihood that women engage in an income generating activity such as FFW. This could mean that most of what was produced was used for household consumption. This supports the hypothesis that the less output sold from agricultural production, the less income earned from sale thus the greater the likelihood that women will participating in FFW.

Although not statistically significant, the logit results suggest that women who are widowed or divorced tend to participate less in FFW programs. It was hypothesized that widowed/divorced women would dominate FFW programs since they are probably the most food insecure and could benefit from income transfers. It may be the case that despite the need for income, widowed/divorced women, or household heads, do not have the time or are too old to participate in FFW activities. According to the logit results however, single women participated more in FFW than married or widowed and divorced women. A possible explanation for this is that the single women are members of a large household where they are unemployed, thus increasing their likelihood to participate in FFW.

Related to marital status is the age of the individual. The coefficients are negative but not statistically significant. The results do suggest, however, that younger women have a higher probability of participating in FFW activities. Women in Ethiopia marry at a very young age so the fact that married women are also more likely to participate in FFW is not surprising. The hypothesis that younger women are less likely to participate because they are usually better skilled and educated, thus leaving rural areas for better opportunities is not supported by these results. There was very little variation in these two variables, therefore this could not be tested adequately.

The main types of FFW activities in these areas were labor intensive which included upgrading roads, reforestation, soil conservation and terracing. Due to the extensive manual labor required of these projects, the expected low involvement of older

women is understandable. Younger women are generally more energetic and physically fit thus being able to participate more in FFW activities.

The log likelihood function at its maximum was -206.6479 with 22 degrees of freedom. This is significant at the 0.000077 level based on a χ^2 test. This significance implies that the overall model is highly reliable in predicting women's participation in FFW activities. To assess how well the logit model predicts female FFW participation, the estimated equation made 79 percent correct predictions. This reveals that the model does a good job of predicting participation rates within the sample.

The coefficients of the logit analysis do not represent the expected change in the dependent variable given a change in the independent variable so appropriate derivatives had to be calculated to estimate the effects of changes in the independent variables on the probability of women participating in FFW programs. The estimates of the change in probability at the sample mean are given in Table 5.9. The positive sign on the parameter estimates implies a direct relationship between this variable and the probability of participating in FFW. Specifically, an increase in the value of an explanatory variable with a positive estimate will increase the odds of an average rural woman participating in FFW activities and an increase in the value of an explanatory variable with a negative estimate will decrease the odds of an average rural woman participating in FFW.

Table 5.9. Change in Probability Estimates

Independent Variable	Estimate[a]	Change in Probability
Constant	-2.44700	
Age	-0.00249	-0.00055
Education	-0.02718	-0.00608
Family size	0.09637	0.02156**
Child labor	-0.00114	-0.00025
Land owned	-0.01147	-0.00256
Amount of output sold	-0.00823	-0.00184***
Total livestock value	-0.00016	-0.00003
Total non-farm income	0.00073	0.00016
Total non-food expenditure	0.00051	0.00011**
Wages from FFW	0.00577	0.00129*
Wages from agricultural work	0.01194	0.00267***

[a] The dummy coefficients were used to calculate probability changes but are not reported in this table because interpreting them would not be appropriate.

Note: $\Delta \ln[P_i/(1-P_i)] = .2238$

*** Significant at the 0.01 level
** Significant at the 0.05 level
* Significant at the 0.10 level

Table 5.9 shows that family size, total household non-food expenditures, women's wages from FFW, and women's wages from agricultural work have positive estimates for their regression coefficients. This implies that increases in the value of these variables will increase the odds of an average rural woman participating in FFW projects. These coefficients were statistically significantly different from zero at the .01, .05 and .10 level of significance, accordingly. The negative coefficient on the amount of output sold suggests that an increase in the amount of output sold, this means an increase in income, will decrease the odds of women participating in FFW activities. At the sample mean, only the family size variable has the largest impact on the probability of FFW participation. Specifically, if we increase family size by one, then we increase the probability of female FFW participation by 2.1 percent. The results show that changing any of the other explanatory variables would only have a small impact on the probability of participating in FFW programs.

V.2.1 Re-Estimation of the Model

Since a number of variables were found to be not statistically significant in the estimated logit model, the model was re-specified and re-estimated after omitting several variables. For the FFW participation model, age, education, OCCUPDUM2, OCCUPDUM4, OCCUPDUM5, MARSTDUM2, MARSTDUM3, REPSTDUM2, REPSTDUM3, child agricultural labor days, household land area, household livestock

value and total non-farm income variables were removed.

The exclusion of the marital status and reproductive status variables is acceptable since we are only concerned with the significant dummy variables that have an influence on female FFW participation. The removal of a child's agricultural labor days variable is also justifiable. Whether one's child participates in FFW will not necessarily influence the mother to participate as well. This variable was employed initially to see if there would be any substitution effect from engaging a child's labor in exchange for a woman's labor, which was not found to be the case.

The removal of the land area in hectares per household is acceptable because households of the study sample are poor and thus the majority of them own less than two hectares of land. The total non-farm income variable was also excluded since it was insignificant in the estimated logit model. Women in Southern Shoa generally engage in non-farm activities such as beer brewing and making handicrafts. However, these activities may not have much of an influence in determining FFW participation. Thus, total non-farm income obtained from such activities may not be a good indicator of FFW participation.

Results of the re-estimation of the logit model show some statistically significant changes from the first estimation. Table 5.10 gives the results of the re-estimated logit model. The significance levels for OCCUPDUM1, REPSTDUM4, and wages from FFW increased slightly from the .10 level to the .05 level, hence making these variables

Table 5.10. Results of the Re-Estimated Logit Model

Independent Variables	Estimated Parameters	t-values
Constant	-2.04630	-5.375***
Occupation DUMMY1	0.49731	1.802**
Reprod. Status DUMMY4	2.15410	1.878**
Marital Status DUMMY4	-0.32606	-1.131
Family size	0.09147	2.282***
Amount of output sold	-0.00568	-2.940***
Total non-food expenditure	0.00051	2.156**
Wages from FFW	0.00448	1.838**
Wages from agricultural work	0.01278	4.327***

Test statistics:

Log of likelihood function at its maximum (ln L_{max}):	-240.2447
Chi-squared (8 degrees of freedom):	58.4466
Significance level:	0.29E-09
Number of correct predictions:	340
Percentage of correct predictions:	82

*** Significant at the 0.01 level
** Significant at the 0.05 level
* Significant at the 0.10 level

statistically significant with a 95 percent probability of influencing female FFW participation. The significance level for family size increased from .05 to .01 making it highly statistically significant.

The log likelihood function at its maximum was -227.9237 with 9 degrees of freedom. This is significant at a higher level compared to the first model. This model made 82 percent correct predictions which is a little better than the first estimated logit probability model.

Changing the explanatory variables of the re-estimated model in order to determine changes in the probability of the dependent variable did not have much impact on the probability of participating in FFW. Table 5.11 illustrates the changes in the probability estimates of the re-estimated model. Again, family size has the largest impact on the probability of FFW participation. Increasing family size by one would increase the probability of participating in FFW by 1.6 percent. The percent change in probabilities of the re-estimated model are slightly smaller than those of the first model but they are highly statistically significant. In both models, the impacts that changes in these explanatory variables have on the probability of FFW participation are not very statistically significantly different from each other.

Table 5.11. Change in Probability Estimates of Re-Estimated Model

Independent Variable	Estimate[a]	Change in Probability
Constant	-2.04630	
Family size	0.09147	0.01668***
Amount of output sold	-0.00568	-0.00103***
Total non-food expenditure	0.00051	-0.00009***
Wages from FFW	0.00448	0.00081**
Wages from agricultural work	0.01278	0.00233***

[a] The dummy coefficients were used to calculate probability changes but are not reported in this table because interpreting them would not be appropriate.

Note: $\Delta \ln[P_i/(1-P_i)] = .1824$

*** Significant at the 0.01 level
** Significant at the 0.05 level
* Significant at the 0.10 level

CHAPTER VI

CONCLUSIONS AND IMPLICATIONS

VI.1 SUMMARY

The primary objective of this research was to determine the significant factors influencing women's participation in FFW projects. The secondary objective was to determine the effects of changes in the probability of women participating in FFW given a change in the explanatory variables.

The problem was identified as a result of data collected by IFPRI/ENI/INN on a public works project that looked at improving seasonal food security. Detailed observations were made of households in three *awrajas*. For this study, only the female sample was taken from the IFPRI/ENI/INN project. A total of 651 females, 185 whom participated in FFW and 466 whom did not, made up the study's sample. Over 60 percent of the sample were single women with only 12 percent as heads of households. The average family size was seven of which 5 percent represented children 13 years old or younger.

A household decision model was used to theoretically explain women's participation in FFW activities. Our study demonstrates that household decision models

can be used to explain household behavior and women's participation in income generating activities such as FFW, as simultaneous decisions concerning consumption patterns, the availability of farm labor and other household activities. Engaging in FFW causes a change in the amount of time allocated to other activities. Along with this change in household time allocation, there may be a change in women's own farm output from participating in FFW activities which in turn affects household income.

The explanatory variables used to predict the probability of female FFW participation were: age, education, marital status, reproductive status, occupation, family size, child agricultural labor days, household land area, value of livestock per household, women's non-farm income, household non-food expenditures, women's wages from FFW and women's wages from agricultural work. A logit probability model was used to determine the significant factors influencing female FFW participation. Logit analysis was also used to determine the changes in the probability of the dependent variable due to changes in the explanatory variables.

Several factors were found to significantly influence female FFW participation in Southern Shoa. The most significant factors were one's occupation, reproductive status, marital status, family size, household non-food expenditures, the amount of output sold from agricultural production, that is farm income, women's wages from FFW, and women's wages from agricultural work, other than FFW. Other variables were not statistically significant in the logit probability model. Based on test statistics, the model significantly predicted women's participation in FFW projects. One model correctly

predicted 79 percent of the sample FFW participation decisions, while a re-specified model correctly predicted 82 percent.

The probability of women participating in FFW activities was found to be positively and significantly related to family size, household non-food expenditures, women's wages from FFW and women's wages from agricultural work. That is, women with larger families participate more in FFW. This is probably due to the need for higher income to feed and maintain a household. Also, with larger families there may be relatively more family labor available to do farm work thus releasing women's time to participate in FFW. The higher the wages from FFW, the greater the likelihood that women would participate in FFW programs. Wages from FFW for the 15 month period were at a higher rate than agricultural wages. Interestingly, the higher the income from agricultural work the more likely it is that women will participate in FFW. This negates our hypothesis. A possible reason for this is that

that given that FFW participation was predominant during the preharvest season, food available at the household level would be lowest, hence the need to participate in FFW activities.

Total household non-food expenditures was also found to be a significant factor influencing female FFW participation. Generally, household non-food expenditures are associated with larger wealth thus decreasing the likelihood of FFW participation. The results, however, show that the more non-food expenditures incurred by a household, the greater the likelihood that a woman will participate in FFW activities. More non-food

expenditures may be associated with larger family sizes which has been shown to be a factor for increased FFW participation. The total amount of output sold from agricultural production appears as a negative and significant variable indicating that the less output sold from agricultural production, also meaning the less output available for market after household consumption, then the greater the chance that a woman will participate in FFW. Also, increased family size is associated with less produce left for the market after consumption.

Surprisingly, age and education were not statistically significant variables in determining female FFW participation. The majority of the women were between the ages of 16-30 which is a younger group at their reproductive peak. They were mostly single and had never had children. Due to a large percentage of the sample in this age range, it is not surprising that age is not a significant factor in explaining female FFW participation.

Other variables that were found not to be statistically significant in influencing women's participation in FFW activities were a child's agricultural labor days, the amount of land area per household, and total household livestock. Children's labor was not a significant factor in influencing women to participate in FFW. The hypothesis was that children could substitute for a woman's time hence enabling women to attend to other chores. However, a child's agricultural labor was not found to affect women's participation in FFW.

Neither amount of land nor livestock that a household had influenced woman's

participation in FFW. These variables were probably not statistically significant in the logit probability model since land and livestock are not liquid assets. The Bezuneh study hypothesized that landless persons would participate more in FFW in the Baringo District in Kenya (Bezuneh, 1985). However, the logit probability model did not find land area per household as a significant variable.

Since there were several variables that did not have a major influence in determining women's decisions to participate in FFW, a second logit model was presented after having omitted some variables. This model was a little better than the first model given that it correctly predicted a higher percentage of the actual behavior. The results of the re-estimated model suggested that single women were less likely to participate in FFW activities. This supports the hypothesis that single women have less expenses and do not support a family, therefore decreasing their likelihood of participating in FFW. The rest of the variables found to be statistically significant in the first model were also found to be statistically significant in the second model.

In both models, increasing family size by one would increase the probability of a woman participating in FFW programs. This implies that the more mouths there are to feed, the greater the likelihood of women participating in FFW activities.
This study has shown that large families are prevalent in the study areas selected. Female participation in FFW activities is therefore, essential since women are in charge of overall household maintenance and taking care of the family and the young.

The results of this study have some implications for increasing female FFW

participation in the Southern Shoa region of Ethiopia. In particular, conclusions may be drawn as to the effectiveness of development programs. The following section discusses implications of the study's results for increasing female participation in food assistance programs.

VI.2 IMPLICATIONS OF THE STUDY

There are some policy implications that can be drawn as a result of this study. Women in the Southern Shoa region of Ethiopia only constitute 20-30 percent of FFW participants, therefore policies need to be considered to increase female FFW participation. Results show that occupation, marital status, reproductive status, family size, household non-food expenditures, output sold from own agricultural production, women's wages from FFW and women's wages from agricultural work are important factors influencing women's participation in FFW. The estimates of the logit model suggest that policy measures directed at influencing female FFW participation should be aimed at demographic factors and income levels of female participants.

Unfortunately, there is not much policy makers can do to address the demographic factors. However, income level can be influenced by policies directed at increasing the wage rates of FFW activities in order to increase FFW income. Since the total income earned from FFW was positively related to women's participation, perhaps a guaranteed

period of work could also increase their participation. With a guaranteed length of employment, the women could better evaluate the risks associated with activities they forgo to participate in FFW programs.

The study shows that family need is expressed by large families, low farm income and small plots of land all of which are major factors in increasing female FFW participation. One possible policy implication is to better target the poorer women by addressing FFW programs that would favor their participation. For example, the FFW projects should be near women's farms, they should be less labor intensive and should eventually promote women's agriculture sector.

VI.3 SUGGESTIONS FOR FURTHER RESEARCH

The use of logit analysis in this study has yielded results that are useful in examining women's participation in FFW programs. This type of model simply considers the probability of whether or not they engage in such programs. Further analysis should be considered evaluating the costs and benefits of FFW projects. If there is to be increased participation by women in FFW programs, there are bound to be some costs incurred, such as redirecting women's time from their productive as well as their reproductive roles.

There may also be additional benefits obtained from increased participation in

FFW projects such as increased income and increased employment. A mathematical programming model may be able to determine the best FFW activity mix that can be implemented to benefit women overall.

Another factor which requires further attention is the risk associated with women's participation in FFW. It is necessary to determine a woman's willingness to take risks. FFW programs are usually short term projects which means once the projects terminate, women are left with no work in which case they can no longer generate steady income to help feed and maintain a household. Knowledge of the nature of the projects themselves, then becomes crucial in order to take such risks.

To consider increasing the involvement of women in development programs, the role of men must also be addressed. Therefore, further analysis that looks at gender comparisons in FFW participation should be conducted. Issues such as what factors affect men's participation and how these factors compare to women's participation should be addressed. Factors that influence one being picked to work on FFW projects versus one's decision to participate in these activities should also be addressed. A woman's participation in development programs generally takes into account the decisions of her entire family so to formulate a comprehensive FFW policy, more information is needed on both the men and women of this region.

REFERENCES

AAFS, Advocates for African Food Security. 1989. *Women's Participation: The Critical Element in Food Security*. New York: AAFS.

Aldrich, J.H. and F.D. Nelson. 1984. *Linear Probability, Logit and Probit Models*. Beverly Hills: Sage Publications.

Amemiya, T. 1981. Qualitative Response Models: A Survey. *Journal of Economic Literature*. 19: 1483-1536.

Athanasios, A. 1986. *Food Security in Less Developed Countries: Assessing the Effects of Food Aid in Rural Kenya as a Food Supply Shock on Consumption and Nutrition*. Thesis. Blacksburg: VPI&SU.

Becker, G.S. 1964. *Human Capital*. New York: Columbia University Press.

_____ 1965. A Theory of the Allocation of Time. *Economic Journal*. 75: 493-517.

_____ 1981. *A Treatise on the Family*. Cambridge: Harvard University Press.

_____ 1985. Human Capital, Effort, and Sexual Division of Labor. *Journal of Labor Economics*. 3: S33-S58.

Bell, K.L., R.W. Hay and T. Martinez. 1989. *Consumers and Savers: Can Food-for-Work Stimulate Economic Growth at the Household Level?* Oxford:University of Oxford.

Belshaw, D. 1990. Food Strategy Formulation and Development Planning in Ethiopia. *IDS Bulletin*. 21(3):31-43.

Berkson, J. 1944. Application of the Logistic Function to Bio-assay. *Journal of the American Statistical Association*. 39:357-65.

Bezuneh, M. 1985. *Food Aid and Economic Development: Impact of Food-for-work on Labor allocation, Production and Consumption Behavior of Small Family Farms in a Semi-arid Area of Kenya*. Dissertation. Blacksburg: VPI&SU.

Boserup, E. 1970. *Women's Role in Economic Development*. London: Allen and Ulwin.

Cathie, J. and H. Dick. 1987. *Food Security and Macroeconomic Stabilization.* Tubingen: Mohr.

Clay, E. and O. Stokke, ed. 1991. *Food Aid Reconsidered: Assessing the Impact on Third World Countries.* London: Frank Cass and Co. Ltd.

Collier, P. and P. Horsnall. 1989. *The Mobility of Women's Labor and Structural Adjustment:Issues and Some Evidence from the Cote d'Ivoire.* Mimeo, Unit for Study of African Economies. Oxford: Oxford University.

EIU, The Economist Intelligence Unit. 1992-93. *Ethiopia, Somaila, Djibouti Country Profile.* London: Business International Ltd.

FAO, Food and Agricultural Organization. 1985. *World Food Security: Selected Themes and Issues.* Rome: FAO.

Graham, J.W. and C.A. Green. 1984. Estimating the Parameter of a Household Production Function with Joint Products. *Review of Economics and Statistics.* 66(2): 277-282.

Greene, W.H. 1991. *LIMDEP Version 6.0, User's Manual and Reference Guide.* New York: Econometric Software Inc.

Gronau, R. 1986. Home Production: A Survey. *Handbook of Labor Economics.* 1: 273-304.

Gujarati, D.N. 1988. *Basic Econometrics.* 2nd ed. New York: McGraw Hill Book Co.

Heckman, J.J. 1978. Dummy Endogenous Variables in a Simultaneous Equation System. *Econometrica.* 46:931-60.

Hossain, M. 1988. *Nature and Impact of the Green Revolution in Bangladesh.* Research Report 67. Washington, D.C.: IFPRI.

Kahneman, D., P. Slovic and A. Tversky. 1982. *Judgement under Uncertainty: Heuristics and Biases.* Cambridge: Cambridge University Press.

Killingsworth, M.R. and J.J. Heckman. 1986. Female Labor Supply: A Survey. *Handbook of Labor Economics.* 1: 103-204.

Kumar, S.K. and O.H. Chowdhury. 1985. *Development Impact of the Food-for-Work Program in Bangladesh.* Washington, D.C.: IFPRI.

Kumar, S.K. 1993. *Public Works Projects in Ethiopia: Potential for Improving Seasonal Food Security and Agricultural Productivity*. Washington, D.C.: IFPRI.

Leslie, J. 1988. Women's Work and Child Nutrition in the Third World. *World Development*. 16:11.

Maddala, G.S. 1983. *Limited-Dependent and Qualitative Variables in Econometrics*. Cambridge: Cambridge University Press.

---------- 1992. *Introduction to Econometrics*. New York: Macmillan Publishing Company.

Malambo, L.M. 1988. *Rural Food Security in Zambia*. Hamburg: Verlag Weltarchiv.

Manser, M. and M. Brown. 1979. Bargaining Analysis of Household Decisions. *Women in the Labor Market*. New York: Columbia University Press.

Maxwell, S.J. and H.W. Singer. 1979. Food Aid to Developing Countries: A Survey. *World Development*. 7:225-47.

McGuire, J. and B. Popkin. 1990. The Zero Sum Game: A Framework for Examining Women and Nutrition, Part 2. *Food and Nutrition Bulletin*. 103:56-82.

Mirotchie, M. 1989. *Productivity Analysis of Private and Socialized Agriculture in Ethiopia*. Dissertation. Blacksburg: VPI&SU.

Norris, P.E. 1985. *Factors influencing the Adoption of Soil Conservation Practices in Virginia's Piedmont Bright Leaf Erosion Control Area*. Thesis. Blacksburg: VPI&SU.

Ott, N. 1992. *Intrafamily Bargaining and Household Decisions*. Frankfurt: Springer-Verlag.

Pankhurst, H. 1992. *Gender, Development and Identity: An Ethiopian Study*. London: Zed Books Ltd.

Rao. A., M.B. Anderson and C.A. Overholt. 1991. *Gender Analysis in Development Planning*. Connecticut: Kumarian Press.

Samuelson, P.A. 1956. Social Indifference Curves. *Quarterly Journal of Economics*. 10(1): 1-22.

Schultz, T.W. 1959. Investment in Man: An Economist's View. *The Social Service Review*. 33: 109-117.

Sen, A. 1993. The Economics of Life and Death. *Scientific American*. 268:40-47.

Shiva, V. 1989. *Staying Alive: Women, Ecology and Development*. London: Zed Books Ltd.

Singer, H., J. Wood and T. Jennings. 1987. *Food Aid: The Challenge and the Opportunity*. Oxford: Clarendon Press.

Staatz, J.M. 1990. *Agricultural Development in the Third World*. Baltimore: Johns Hopkins University Press.

Tobin, J. 1958. Estimation of Relationships for Limited Dependent Variables. *Econometrica*. 26:24-36.

Varian, H. 1984. *Microeconomic Analysis*. 2nd ed. New York: Norton Publishing Company.

von Braun, J., T. Teklu and P. Webb. 1991. *Labor-Intensive Public Works for Food Security: Experience in Africa*. Working paper no. 6. Washington, D.C.: IFPRI.

von Winterfeldt, D. and W. Edwards. 1986. *Decision Analysis and Behavioral Research*. Cambridge: Cambridge University Press.

Webb, P., J. von Braun and Y. Yohannes. 1992. *Famine in Ethiopia: Policy Implications of Coping Failure at National and Household Levels*. Research Report. Washington, D.C.: IFPRI.

WFP, World Food Programme. 1986. *Food Aid for Development in Sub-Saharan Africa*. Rome: WFP.

---------- 1992. *Food Aid Review*. Rome: WFP.

World Bank. 1992. *World Development Report*. New York: Oxford University Press.

Zuhair, M.M.S., 1986. *Harvesting Behavior of Perennial Cash Crops: A Decision Theoretic Study*. Dissertation. Blacksburg: VPI & SU.

APPENDIX A

Logit Probability Model Printouts

Multinomial Logit Model
Maximum Likelihood Estimates
Log-Likelihood..... -206.6479
Restricted (Slopes=0) Log-L. -234.7910
Chi-Squared (22)..... 56.28621
Significance Level..... 0.7779042E-04

Variable	Coefficient	Std. Error	t-ratio	Prob|t|≥x	Mean of X	Std.Dev.of X
Constant	-2.4470	1.042	-2.348	0.01887		
AGE	-0.24960E-02	0.1190E-01	-0.210	0.83385	28.408	10.419
EDUCAT	-0.27183E-01	0.9090E-01	-0.299	0.76490	0.60845	1.7808
MARST2	-0.77396	0.5820	-1.330	0.18358	0.70423E-01	0.25622
MARST3	-0.13534E-02	0.8171	-0.002	0.99868	0.25352E-01	0.15741
MARST4	0.29640E-01	0.7978	0.037	0.97036	0.67606	0.46864
REPST2	0.93554	0.9243	1.012	0.31147	0.61972E-01	0.24144
REPST3	0.99812	1.124	0.888	0.37451	0.25352E-01	0.15741
REPST4	2.1737	1.440	1.509	0.13129	0.11268E-01	0.10570
REPST5	0.74293	0.8481	0.876	0.38103	0.98592E-01	0.29853
OCCUP1	0.63829	0.4459	1.431	0.15233	0.44225	0.49736
OCCUP2	0.55045	0.8193	0.672	0.50169	0.14085	0.34835
OCCUP4	0.18976	0.7286	0.260	0.79451	0.70423E-01	0.25622
OCCUP5	0.24793	0.5977	0.415	0.67830	0.92958E-01	0.29078
FMSIZE	0.96379E-01	0.5027E-01	1.917	0.05521	7.0513	3.0072
CHILDLAB	-0.11452E-02	0.2957E-02	-0.387	0.69851	24.839	43.125
LANDTOTH	-0.11475E-01	0.8872E-01	-0.129	0.89709	1.8530	1.6171
TOTSLDKG	-0.82395E-02	0.2667E-02	-3.089	0.00201	36.189	124.76
TLVINC	-0.16730E-03	0.2646E-03	-0.632	0.52726	241.12	475.08
TNFINC	0.73409E-03	0.9691E-03	0.758	0.44873	81.481	123.58
TNFEXP	0.51349E-03	0.2921E-03	1.758	0.07879	499.53	566.22
TOTWAGE1	0.57722E-02	0.3333E-02	1.732	0.08326	41.227	70.253
TOTWAGE2	0.11944E-01	0.3434E-02	3.478	0.00050	39.745	48.350

Multinomial Logit Model
Maximum Likelihood Estimates
Log-Likelihood..... -240.2447
Restricted (Slopes=0) Log-L. -269.4680
Chi-Squared (8)..... 58.44665
Significance Level..... 0.2995745E-09

Variable	Coefficient	Std. Error	t-ratio	Prob|t|≥x	Mean of X	Std.Dev.of X
Constant	-2.0463	0.3807	-5.375	0.00000		
MARST4	-0.32606	0.2883	-1.131	0.25807	0.66586	0.47226
REPST4	2.1541	1.147	1.878	0.06037	0.12107E-01	0.10949
OCCUP1	0.49731	0.2760	1.802	0.07157	0.43099	0.49582
FMSIZE	0.91476E-01	0.4009E-01	2.282	0.02250	6.8127	3.0256
TOTSLDKG	-0.56859E-02	0.1934E-02	-2.940	0.00328	33.044	118.69
TNFEXP	0.51501E-03	0.2388E-03	2.156	0.03106	457.69	550.12
TOTWAGE1	0.44804E-02	0.2437E-02	1.838	0.06600	40.249	69.836
TOTWAGE2	0.12781E-01	0.2953E-02	4.327	0.00002	38.221	47.010

APPENDIX B

Change in Probability Estimate Calculations

Variable	Estimate	Mean of X	Estimate*Mean	Prob change
CONSTANT	-1.8088		-1.8088	
AGE	-.00249	28.408	-.07073592	-.000557298674
EDUC	-.02718	.60845	-.016537671	-.006083284323
MARSTDUM2	-.77396	.07042	-.0545022632	-.173223647326
MARSTDUM3	-.00135	.02535	-.0000342225	-.000302149884
MARSTDUM4	.02964	.67606	.0200384184	.0066338685549
REPSTDUM2	.93554	.06197	.0579754138	.209387631168
REPSTDUM3	.99812	.02535	.025302342	.223393956882
REPSTDUM4	2.1737	.01126	.024475862	.486506075497
REPSTDUM5	.74293	.09859	.0732454687	.166278676298
OCCUPDUM1	-.08784	.14085	-.012372264	-.019659885758
OCCUPDUM2	-.63829	.25352	-.1618192808	-.1428587031
OCCUPDUM4	-.44853	.07042	-.0315854826	-.100387620206
OCCUPDUM5	-.39037	.09295	-.0362848915	-.087370555593
FMSIZE	.09637	7.0513	.679533781	.0215690253925
CHILDLAB	-.00114	24.839	-.02831646	-.000255148791
LANDTOTH	-.01147	1.853	-.02125391	-.002567154937
TOTSLD	-.00823	36.189	-.29783547	-.001841995216
TLSVAL	-.00016	241.12	-.0385792	-.000035810357
TNFINC	.00073	81.481	.05948113	.0001633847519
TNFEXP	.00051	499.53	.2547603	.0001141455116
TOTWAGE1	.00577	41.227	.23787979	.0012914109839
TOTWAGE2	.01194	39.745	.4745553	.0026723478592
		Xi'B	-.6714092297	
		exp (Xi'B	.510987970731	
		1+exp(Xi'	2.28308464769	
		ratio==>	.223814728572	

Variable	Estimate	Mean of X	Estimate*Mean	Prob change
CONSTANT	-2.0463		-2.0463	
OCCUPDUM1	.49731	.43099	.2143356369	.0907327006961
REPSTDUM3	2.1541	.0121	.02606461	.393009009611
MARSTDUM3	-.32606	.66586	-.2171103116	-.059488657757
FMSIZE	.09147	6.8127	.623157669	.0166884239864
TOTSLD	-.00568	33.044	-.18768992	-.001036298767
TNFEXP	-.00051	457.69	-.2334219	-.000093047953
TOTWAGE1	.00448	40.249	.18031552	.0008173624080
TOTWAGE2	.01278	38.221	.48846438	.0023316722264
	Xi'B		-1.1521843157	
	exp (Xi'B)		.315945889537	
	1+exp(Xi'B		1.73171358419	
	ratio==>		.18244696607	

APPENDIX C

Frequency Distribution of Explanatory Variables

	AGE					
OCCUP	11-20	21-30	31-40	41-50	51-65	Total
N/A	56	89	42	26	9	222
Farmer	25	28	16	8	2	79
Hskeepr	37	46	22	14	2	121
Student	10	9	11	3	0	33
Herder	12	10	9	5	2	38
No occup	1	3	3	3	0	10
Total	141	175	103	59	15	503

	AGE					
REPST	11-20	21-30	31-40	41-50	51-65	Total
N/A	113	160	78	48	12	411
Lact	10	11	5	2	1	29
Pregt	5	5	3	4	1	18
Preg/lact	3	1	0	0	0	4
Not Preg/ Not lact	11	18	10	7	3	49
Total	142	195	96	61	17	511

	AGE					
MARST	11-20	21-30	31-40	41-50	51-65	Total
Marr/mong	35	37	20	14	4	110
Marr/polyg	9	15	9	3	1	37
Widow/ divorce	3	6	2	2	0	13
Single	94	136	73	42	10	355
Total	141	194	104	61	15	515

	AGE					
EDUC	11-20	21-30	31-40	41-50	51-65	Total
0 years	120	172	87	52	10	441
1-3 years	7	5	9	5	0	26
4-6 years	11	9	8	3	3	34
7-9 years	2	3	2	0	0	7
10-12 years	2	1	0	0	0	3
Total	142	190	106	60	13	511

	MARITAL STATUS				
OCCUP	Marr/mong	Marr/polyg	Widow/divorce	Single	Total
N/A	6	0	0	293	299
Farmer	65	21	2	7	95
Hskeepr	70	23	11	38	142
Student	0	0	0	47	47
Herder	1	0	0	37	38
No occup	0	0	2	9	11
Total	142	44	15	431	632

	REPRODUCTIVE STATUS					
OCCUP	No children	Lactating	Pregnant	Preg/Lact	Not preg/ Not lact	Total
N/A	295	2	0	0	4	301
Farmer	91	2	2	0	2	97
Hskeepr	38	35	18	6	47	144
Student	47	0	0	0	0	47
Herder	37	0	0	0	1	38
No occup	8	0	0	0	3	11
Total	516	39	20	6	57	638

VITAE

The author was born in Addis Ababa, Ethiopia on February 2, 1972. She earned a B.A. degree in Economics along with French and Spanish minors from Virginia Polytechnic Institute and State University (VPI & SU) in May 1992. She continued on to Graduate School at VPI & SU in August 1992. Since then, she has been working as a Research Assistant in the Department of Agricultural and Applied Economics in conjunction with the International Food Policy Research Institute (IFPRI) while completing her M.S. degree in Agricultural and Applied Economics.