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

by

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Thesis submitted to the Faculty of the

Virginia Polytechnic Institute and State University

in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

Agricultural Economics

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March 1985
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(ABSTRACT)

Food-for-Work (FFW) was conceived as both a short-run assistance program for meeting basic food needs of low income households, and as a long-run developmental tool for building infrastructure and for providing income to ease capital constraints on farm production. However, it was feared that FFW might divert labor from own-farm production and reduce the level of locally produced food crops. The purpose of this dissertation was to empirically examine these hypotheses in the Ewalel and Marigat locations of Baringo District, Rift Valley Province, Kenya.

A household-firm model that integrated both production and consumption concerns of FFW was developed. The model was block recursive. First, production decisions were made by maximizing net returns (net income) subject to production constraints. This output (income) was then substituted into the budget constraint, and household utility was maximized subject to this budget constraint and to a total time constraint.

The data used in the study was drawn from a representative sample of 300 households were randomly selected in Marigat-Ewalel

locations. Of these, 100 were found to be participants in the FFW Project supported by the UN/FAO World Food Program. Food items provided to the program in the study area are maize, beans, and vegetable oil.

A two-year linear programming model was developed for the production segment of the model. In this model, three crops under two technologies and two types of livestock were used. The household consumption component of the model was specified econometrically using systems of demand equations, the Almost Ideal Demand System. Seven commodities including FFW items, five foods, non-food and leisure, were used in the system. The analysis was conducted for both participant and non-participant households to compare levels of production activities, employment, income, and consumption patterns with and without the FFW program.

The production component of the analysis revealed that the following results were associated with FFW in the study area: (a) augments own-farm output by contributing to the minimum nutrient requirement, (b) eases the capital constraint by the second year of participation, (c) increases the marketable surplus from both own-crop and livestock production, (d) increases hired labor in farm production, (e) causes a shift from maize to millet production, and (f) increases savings. As a result, the net income for the representative farm households with FFW is 52% higher than those without FFW; and participation in the FFW program declines by 11% from year 1 to year 2.

Thus, disincentive effects on own-farm employment and output were not found in this study. In fact, according to the model used, the FFW Program could be expanded by either increasing the monthly participation hours or the number of participants without resulting in any production disincentive.

The results of the entire household-firm model, which reveals the changes in consumption resulting from participation in FFW and changes in income, were derived in elasticity form. Most of the benefits to the representative participant households, as compared to non-participants, take the form of increased consumption of food items. Thus, the primary effects of FFW are to insure participants increased consumption and saving without creating disincentives to either own-farming or to local agricultural production.

To all those people for whom I care very much

ACKNOWLEDGEMENTS

This dissertation was written under the supervision of Professor Brady J. Deaton (major advisor), and was funded by the National Science Foundation, under the Division of Science in Developing Countries (Project number INT-8312018). I am indebted to Professor Deaton for his interest and belief in me, and for his patient guidance and continuous encouragement to work on this topic during these past six years. Without his willingness to adjust his domestic responsibilities and respond to ideas and time required to counsel, this study would not have been completed.

Sincere appreciation is extended to Dr. George Norton for his invaluable contributions at every stage of the dissertation, and for his general interest in my progress. He always made himself available for guidance and for answering questions, especially those concerning the production component of the study and the data.

Thanks also are due to Dr. Oral Capps, Jr. for his generous assistance on the consumption segment of the study. Drs. Ernest Bentley, Leonard Shabman, Richard Simon, and Daniel Taylor have also benefited me through their invaluable specific comments and general discussions at various levels of the study. I am also grateful to Professor Ralph Kline for his encouragement and fatherly advice throughout my graduate study, and to Professor Joseph Havlicek who benefited me through his teaching and comments during the early phase of the study.

Additional financial support for this study was provided by the International Agricultural Office of the University, Title XII, and the Department of Agricultural Economics. My special recognition in this regard goes to Drs. Howard Massey (Director of the Office of International Development) and Herbert Stoevener (Head of the Department of Agricultural Economics) who extended their support during both the data collection and the analysis stages. I also value the contribution made by Dr. Bernard LaBerge (Assistant Dean of Graduate School), not only while I was away for field work but also during my entire stay at VPI and SU.

The household level data collected for this study could not have come to fruition without the support of Egerton College (Njoro, Kenya). In this regard, thanks are due to (Principal) for granting me research and teaching fellowship status, and (who was then Chief of party for SECID/Government of Kenya Project at Egerton College) for giving me his full support so that I might conduct my field work while teaching at Egerton. I am greatly indebted to (former student fellow and colleague, and now head of department of economics at Egerton College) whose enormous guidance and assistance made the data collection possible. It is his leadership to the overall field work that made both the pre-survey and the actual household survey process that much easier. He was fully "responsible" for my being at Egerton and on the field.

I also would like to thank (who was then provisional range officer, and now lecturer at Egerton) for his countless transportation support, and (lecturer at Egerton) for her untiring assistance in pre-coding the data. , , and , also, assisted on pre-coding the data. I have also received invaluable advice from (deputy principal of Jomo Kenyatta College of Agriculture and Technology). The presence of and (both from Virginia State University) at Egerton College, and and (Egerton staff members) made my stay at Egerton more enjoyable and exciting.

On the field, the following individuals have benefited me enormously: (technical assistant), (Senior Range Officer), (District Range Officer), (Soil-water and FFW specialist), (technical assistant), (Assistant Chief), (Chief), and the 16 enumerators.

Thanks are also extended to (who was then WFP project specialist in Kenya), (director of WFP in Kenya), and (staff of WFP at Nairobi) for their overall guidance and information about WFP/FFW projects in Kenya.

This study took an enormous amount of time and computer work during both data preparation and final analysis. This could not have been possible without an enormous amount of assistance from our Data Lab crew. and made particularly

invaluable programming and data analysis contributions.

entered the entire data set into the computer. was always there (day and night) to answer my questions and to pull me out not only from programming difficulties but also from computer-financial crises. also assisted. made sure that I had this assistance on a continual basis. I am indebted to these individuals.

My special thanks go to for typing two chapters of the earlier draft, and and for untiring support in preparing and typing the draft and the final dissertation. has also helped in typing. (fellow student) made valuable contributions in computer and data work, and in helping prepare the final figures used.

I also would like to acknowledge the personal encouragement and confidence I have received from who always hugs me and says, "Mesfin, you are going to make it", and (former student fellow) who daily encouraged me to be interested in my graduate program, and (fellow student), and Drs. Lawrence Grossman (Geography department) and Josia Tlou (Education Department) who continually remind me that the world is not centered around my dissertation, and that there are other interesting things to talk about.

Finally, I give the largest share of credit to my parents, sisters and brothers for believing in me and lending their full support so that

I could complete my studies, and to my loving and dearest wife, , for her selfless support and, most of all, for not giving up on me after being in school so many years. This dissertation is dedicated to these individuals.

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INTRODUCTION

1.1. *INTRODUCTION*

Hunger, famine and unemployment continue to plague Third World Countries as the gap widens between rich and poor income classes (ILO, 1976). A growing concern has been expressed in recent years about meeting the "basic human needs" of the poorest members of society in Third World Countries (ILO, 1977; World Bank, 1979). This new emphasis came about, in part, as a reaction to the perceived failure of capital-intensive "trickle down" development strategies, and was evidenced by a call for a "new development approach" in the 18th International Conference of Agricultural Economists, and in the 1983 UN/World Food Programme Conference (The Hague, 1983).

In the early 70s, the World Bank, the UN, and other foreign assistance agencies all declared a program of action that (at least in principle) contributes to the development process of Third World Countries at grass-root levels which is consistent with the basic needs development strategy. Food aid is viewed as one tool for helping achieve this goal because it helps relax resource constraints to development at both the macro and microeconomic level. Food aid serves to alleviate foreign exchange pressures. Theoretically, recipient countries can substitute food aid for commercial food imports, thereby increasing their earnings of foreign exchange. This in turn frees local

resources for alternative developmental uses. At the micro level, human capital improvements can be generated through nutritional gains from food aid and through new job skills learned on food-aid assisted projects. In addition, because of the large share of consumer expenditure in underdeveloped countries going for the purchase of food, there are likely to be major macroeconomic policy implications flowing from food aid programs, as well as the microeconomic impacts on the market for food.

In this chapter, the current situation and a general conceptual discussion of food aid is first presented. Second, the researchable problem and objectives of the study are discussed. Finally, previous empirical studies are reviewed.

1.2. *THE SITUATION*

Food aid can play a leading role in a national process of economic development if it is integrated with a broader economic development program (McClelland, 1981). However, the food aid-development relationship has been debated on a wide range of issues based on different approaches and world outlooks. The following three concerns have dominated the economic literature and evoked serious policy concern:

1. Food aid may have a significant disincentive impact on agricultural production in recipient countries.
2. Food aid does not reach the very poor through "standard" market mechanisms.

3. Even direct distribution of food aid to the targeted population may not have any long-term developmental impact.

Three additional criticisms of food aid as a developmental tool have been cited (Austin and Wallerstein, 1979): (1) that food aid ignores local food preferences in disposing of surpluses and develops nutritionally adverse feeding preferences and patterns, (2) that food aid may be used for political or military motives which contribute little to development, and (3) that food aid increases external food dependency and dampens recipient country and local community initiatives.

The problem of using food aid as a developmental tool is exacerbated by the multiple objectives of food aid programs from the perspective of the donor nations. McClelland has identified five objectives of the P.L. 480 program of the U.S. government:

1. disposal of surplus agricultural commodities,
2. market development for commercial agricultural exports,
3. to promote economic and political stability in recipient nations,
4. relief of suffering from famine or near-famine situations, and
5. to promote long term economic development of recipients.

In a broader context Sexauer (1980), drawing on the work of Isenman and Singer, identified five ways in which food aid can potentially benefit the recipient nations:

1. It can help feed the needy, either directly through subsidized distribution or indirectly through reduced food prices,

2. it can finance development projects either directly in food-for-work projects or indirectly through the generation of additional government revenues,
3. it can be used to build domestic buffer stocks and thus help reduce price fluctuations,
4. it can ease constraints on economic growth, and
5. it can reduce domestic political pressures and instability.

As Schultz (1960), Schuh (1979), Dumont and Cohen (1980), Lappe and Collins (1977), Jones (1976), and others have pointed out food aid is based on the surplus supplies of the donors. Thus, food aid is highly sensitive to the supply side of agricultural surpluses and might even be inversely related to the needs of recipient countries if shortages occur at the same time in both donor and recipient countries. The stability of food aid is highly unpredictable, and the donors, regardless of their intentions, neither could be nor are a long-run source of food security.

Three types of potential dependencies on food aid have been identified by Maxwell and Singer:

1. Recipient nations may become dependent upon food from outside sources and become less likely to develop their own domestic supplies of food;
2. Food aid may be used to encourage and assist in the penetration of the recipient economy by foreign business interests, thus creating the potential for economic dependency; and

3. Revenues earned by the sale of food from food aid programs may act as a kind of fiscal disincentive by preventing or delaying the development of domestic revenue sources.

Schuh has pointed out that there may also arise a dependence on food aid on the part of the donor nations as a means of expanding markets for agricultural products as a substitute for domestic adjustment policies. If food aid programs are to effectively deal with the nutritional needs of the recipients, then food aid must be counter-cyclical to the pattern of food production in the recipient nations, or at least neutral (Mellor, 1980). To the extent that supplies in the donor and recipient nations are positively correlated and to the extent that conditions in both the donor and recipient nations affect the quantity of food aid available, then there are likely to be forces preventing food aid from playing this counter-cyclical role.

Food aid is also criticized because it accelerates consumption instead of investment. Such criticism, however, may be less applicable now than it was 10 or 20 years ago when the emphasis was on increasing the rates of saving, investment, and production as the driving forces of development (Higgins, 1959). Consumption activities, in the traditional analysis, are treated as costs and contribute little to future production. However, when consumption directly translates into improving nutritional levels, it could have a larger impact on both current output (for example, when food aid reaches the working age group) and future output (for example, feeding pre-school children)

than the accounting category of investment *per se*. It has also been argued that if food aid makes a positive contribution to employment, nutrition, income, and other aspects of the development process, then food aid will inevitably serve as one means of reducing population growth, which is one of the chronic problems of most Third World countries (Isenman and Singer, 1977).

Empirical evidence to substantiate the validity of these concerns is uneven and inconclusive (Maxwell and Singer, 1979). The range of policy measures that can be used overtly to avoid the most serious negative effects and to develop a strategic approach to economic development have not been identified and are most likely specific to the social and political milieu of each country (Deaton, 1980; Maxwell and Singer, 1979). The effectiveness of food aid in promoting a basic needs development strategy clearly depends upon the conditions under which food aid is disseminated and the skill with which the food aid is administered (Maxwell and Singer, 1979; Schuh, 1981).

In response to these concerns, a new strategy called Food-For-Work (FFW) began to emerge. This program emphasizes the relationship between food and basic human resource development by selecting "target groups". Food-for-work strategies were conceived as more effective means of reaching the poor, since wage payments in the form of food are concentrated on low-income workers. Ideally, such programs could simultaneously achieve such objectives as increased agricultural output and a more equitable distribution of income (Schuh, 1979).

Food-for-work programs can be used to build physical infrastructure that serves to stimulate economic development while simultaneously providing employment opportunities to low income families in the subsistence sector of the economy. Such infrastructure may support agricultural productivity either on the input side (roads, irrigation, fertilizer plants) or on the output side (new marketing facilities, transportation, processing facilities). Such infrastructural support to agricultural production may help alleviate conditions which could potentially result in price disincentives as a greater quantity of food is placed on the domestic market. That is, the cost reducing effect could more than offset any output price reduction if the food aid program is implemented under guidelines formulated in recognition of its potential negative effects on output prices.

Both agricultural and non-agricultural sectors within the rural areas of the recipient country may benefit from rural infrastructure developed by food-aid assisted projects. The enhanced wage and/or income advantages to rural farmers are, in turn, expected to reduce urban-rural real income differentials and, thereby, reduce the rate of rural-urban migration, a source of one of the chronic problems of most Third World Countries (Todaro, 1969, 1974). Hence, the quality of the rural population may be enhanced through a variety of human capital creating mechanisms (Schultz, 1979).

A detailed analysis of the long-term macro and micro effects of food aid programs and a formal consideration of various criticisms of

food aid raised above is beyond the scope of this study. Instead, the study will examine the impact of FFW on FFW participant households in the recipient countries. Thus, the broader question of this study is: what is the contribution of FFW to a basic needs strategy of development? The following sections discuss the conceptual arguments made for implementing FFW, state the researchable problem and objectives of this study, and present a brief review of previous work.

1.3. *FFW PROGRAMS: THE NEW STRATEGY*

Food-for-work strategies were conceived in the mid-1970s as a means of achieving twin objectives: (1) meeting food needs of targeted, low-income families, and (2) utilizing "surplus" labor to build rural infrastructure. The underlying rationale was that the "free" labor resource would create productive capital capable of yielding permanently higher income streams to the targeted community. Ideally, such programs would simultaneously achieve the objectives of increased agricultural output and a more equitable distribution of income (Deaton, 1980; Maxwell and Singer, 1979; Schuh, 1979) which in turn leads to a higher level of consumption and improved nutritional status of rural households. On the other hand, FFW may divert labor from own-farm production and reduce the level of locally produced food crops and increase food dependency.

It has been long argued by various writers in the field of development that there are two causes of increasing poverty in the Third World countries:

1) the unequal ownership of productive assets, land in particular;

2) the presence of unequal allocative mechanisms which favor the owners of wealth (i.e., including capital accumulation and technical innovations), and discriminate against the lower income class (Griffin and Khan 1976).

Thus, in order for FFW programs to be a developmental tool, they should meet one or a combination of the following objectives:

1. New training opportunities and new skills for participants resulting in new or more secure income earning ability on the part of participant families;
2. New opportunities for savings and investment on the part of participant families and improved material quality of life.
3. Greater income earning potential of participants. FFW projects should be designed to create income generating assets for participant as well as non-participant families
4. Improved health and nutrition of recipient families.

FFW programs have the potential capacity to expand both supply and demand simultaneously. Further arguments have been made that the traditional conflicts between consumption and production oriented developmental goals can be overcome by adopting FFW programs which, by design, mobilize idle or unemployed resources and pay wages in food. In turn, this process promotes consumption and the development of capital goods which in turn, promote long-term development (Smucker, *et al.*, 1979).

Ideally, such programs increase employment opportunities, increase agricultural output, create human and physical capital in both private and public sectors, and promote more equitable distribution of income. Maxwell (1978) and Sanderson (1979) contend that food-for-work is the only visible program that directly improves the poor's share of wealth from food aid. Schuh (1979) also contends that poorer people do not capture the major benefits from food aid since a great portion of it is used to subsidize capital-intensive projects. He supports food-for-work as an effective tool to give employment opportunities to the poorest people.

One justification for implementing FFW projects is the belief that such projects promote the formation of physical and human capital resulting in increased labor productivity. Additional human capital accrues through:

1) improved nutrition, since FFW reaches the poor directly;
2) increased skill levels of employees; and/or
3) entry of new employees into the labor force, the effects of which persist beyond the terms of the projects.

The other justification for implementing FFW projects is the belief that such projects can speed up the adoption of new agricultural technologies by reducing the risk of catastrophe in the case of crop failure (Austin and Wallerstein, 1977). If food aid is used to promote local goals, then food aid programs can perform a central role in linking FFW programs to locally identified basic needs.

Of equal importance, however, is the argument that FFW programs have a disincentive impact on subsistence agricultural production. As indicated above, FFW increases rural production in terms of both physical and human capital on the one hand. On the other hand, FFW might counteract food production at subsistence levels in two different ways. First, assuming the level of local food consumption is constant, local food prices will be decreased since a fraction of the population that participates in the projects is now substituting food aid for his/her local food purchases. Schultz has argued that this will result in a reduction of food production in the subsistence sector, while Khatkhate has argued on the contrary. Second, depending on the season and amount of time spent on FFW projects, and assuming that demand for food is fixed, one would expect a reduction in farming activities (Stevens, 1979).

Central to FFW Programs is the belief that they will draw upon a residual labor force not employed in either Cash-Paid Projects (CPPs) or in any other wage-earning activities because FFW programs are expected to have a lower social status as compared to cash-paid programs (Stevens, 1979); and hence, only those unemployed will be attracted. In other words, the poor are more likely than higher income groups to participate in FFW because their entry in CPPs may be foreclosed. In this regard, gains from FFW could be considered as net additions to the participants' income. These and other micro related issues raised above will be analyzed in this study.

1.4. *THE PROBLEM AND OBJECTIVES*

As discussed above, there is a consensus that conceptually FFW could lead to increased real income for low income laborers. Thus, much of the debate about FFW Programs is not on theoretical but rather on empirical grounds. While there is a body of theoretical literature on the effects of FFW programs, there is little empirical research. While Stevens and others have examined various FFW programs, their works are largely descriptive and evaluate neither the effects of these programs on achieving identified objectives nor provide information on the household level consequences of the programs. There exists no empirical evidence to substantiate the theoretical claims raised above. An important research question then arises for an analysis of whether FFW is an effective means of generating additional and permanent income for the FFW participant households through its impacts on employment and production of rural households. This research thus focuses on the following questions:

1. What are the effects of FFW programs on employment or, more specifically, on demand and supply of agricultural labor, production, consumption, and income?

2. How does FFW affect the overall allocation of household time to production and leisure activities?

3. Who are the actual participants in FFW projects? Are they predominately households with land, mostly landless, or some combination of the two?

4. Are the benefits from FFW distributed to landed households in a significantly different fashion as compared to landless households?

The purpose of this study is to analyze the impacts of the FFW program on farm households in the Baringo District, Rift Valley Province, Kenya. More specific objectives are first to analyze its effect on (a) labor allocation, (b) production, and (c) income, and second on the allocation of income generated from the production side to various consumer goods (food and non-food items) and leisure. The specific hypothesis to be tested is that the rural farm households who participate in the FFW program divert labor from own production to FFW Projects thereby resulting in reduced output from own farming. In other words, FFW Programs may have disincentive effects through the process of labor reallocation. Regardless, the net income of recipient households may be greater than if they had not participated. If so, this net gain is hypothesized in turn to result in increased: (a) employment opportunities in the area, (b) output from own farming by relaxing the capital constraint in the subsequent years, and (c) level of food consumption, and hence, nutritional status of the recipient families.

1.5. *PREVIOUS STUDIES*

In almost all recipient countries, food aid affects both the supply and demand of food through market prices. Normally, food aid imports would be expected to reduce farmers' income and increase consumers' income through its depressing impact on domestic food prices. Hence,

the traditional conflict between producers and consumers seems to be aggravated when food aid is integrated into general welfare concerns and increased output. In other words, non-subsistence producers often need higher prices to increase production while consumers, the poor in particular, require lower prices to raise and stabilize their living standards. However, previous analyses of food aid have been entirely focused on the disincentive effect of food aid on production. The consumption and/or income potential of food aid has been largely ignored in current literature.

Two basic arguments have been the dominant justification for the extensive research in the area of disincentives (Schultz, 1960; Nelson, 1981): a) that food aid has a great potential of dampening both short-run and long-run price incentives to producers; and b) that food aid in the long-run weakens incentives to develop an effective agricultural policy of a recipient government. It is argued that these price and policy disincentives (or distortions) could lead to economic inefficiency and misallocation of scarce resources. Thus, several analyses of the food aid-price effects relationship have been undertaken (Bezuneh and Deaton, 1981; Blandford and Von Plocki, 1977; Hall, 1980; Mann, 1967; Rogers and *et al*, 1972; Seevers, 1968).

The results of these studies, however, do not provide a comprehensive guide to domestic food aid policy in recipient countries. This is because neither the specific role that food aid plays in consumption and income distribution nor the extent to which the

possible disincentive affects both production and consumption simultaneously are explicitly addressed.

Sen and others have argued that the original Schultz's formulation of the disincentive issue, which was the starting point of food aid analysis of the last two decades, ignores the income creating potential of food aid. The increased food demand that grows out of derived income growth may offset in full, or at least in part, the impact of lower prices on domestic supply, depending upon the elasticity of demand (Sen, 1960, 1971; Dantwala, 1967; Bezuneh and Deaton, 1981).

In particular, if food aid is disseminated to the poor either through differentiated markets, such as "fair-price shops", at subsidized prices or other target programs (e.g., school children feeding, FFW), then some families will experience a net gain in real income since they now have relatively cheaper food than they would have had otherwise. Since the income effect of food aid is relatively greater for the low income families, i.e., because of their relatively higher income elasticity of demand for food, the gain in real income may result in an increase in food demand. Figure 1.1 shows the direction of the potential shift of the aggregate demand for food as a result of food aid. The income effect is represented by the shift from P_0 to P_2 and from Q_0 to Q_2 respectively. For example, Schultz's formulation underestimates domestic production by a distance equal to Q_1^S Q_2^S which leads to underestimation of producers benefits by P_2BCP_1 (Figure 1.1).

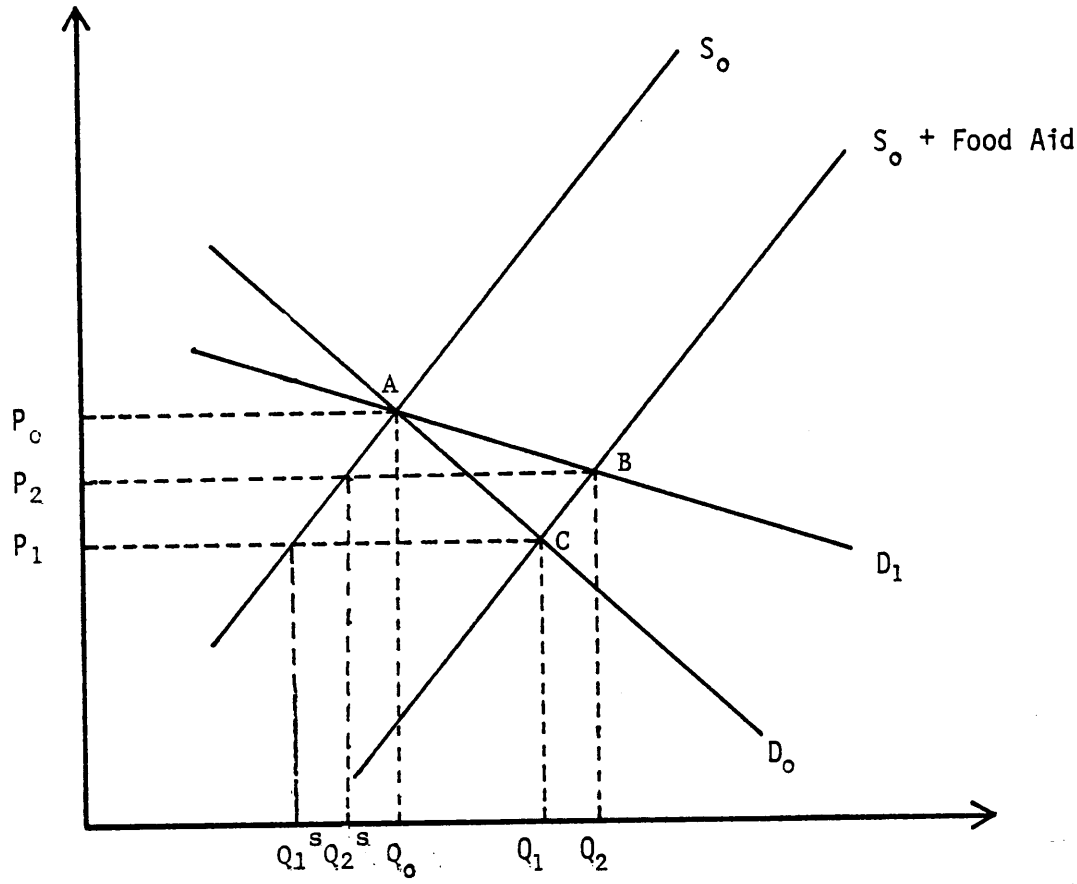

Figure 1.1. Aggregated Food Supply and Demand in Recipient Countries

Although, the existing food aid disincentive literature includes, by definition, both the demand and supply side of the recipients' food systems; the implications they draw are highly aggregative and only indicate either the net gain or loss of consumer welfare. For example, consumers in the recipient country have a net gain of P_0ABP_2 (Fig. 1.1) (see for example: Mann, 1967; Rogers, *et al*, 1972; Blandford and VonPlocki, 1977). But, the specific effects of food aid on domestic food price to the extent that they affect wages and/or employment, consumption, and the distribution of these consumption gains (i.e., P_0ABP_2) are the least studied part of the existing food aid-development literature. What is generally lacking in the literature, therefore, are studies which directly relate food aid to production and consumption behavior at the household level.

Any effort to improve the development process of Third World Countries must of necessity integrate production and consumption (or distribution) into the same policy basket. It is towards the combining of production, consumption, distribution, and employment goals into one developmental policy rather than to their separation, that food aid might have its greatest contribution to development strategies. However, the analytical tools used in understanding questions such as those mentioned above have been limited in scope especially with respect to the dynamic effects of food aid.

Until an appropriate analytical framework that incorporates concerns of production, consumption, employment, and distribution is

developed and until more detailed assessments of peasant household behavior can be made in an economic environment influenced by food aid imports, the developmental consequences of international food assistance will remain cloudy (Bezuneh and Deaton, 1981).

This study will be directed toward the development of a Peasant Household Firm (PHF) model that incorporates both the production and consumption effects of FFW programs. This approach will provide a more adequate framework for exploring the dynamics of food aid in the development process of the recipient economy.

This study is concerned only with the role of FFW in the process of production and consumption behavior of participant rural households in Kenya. The approach is based on a single agricultural production period (one year) and, therefore, does not represent a complete or exhaustive model that encompasses many issues previously discussed. A significant element in the development of this model is the hypothesis that FFW programs affect the dual role of the farm household as both producer and consumer through their impacts on demand and supply of agricultural labor, production, consumption and, hence, income.

1.6. *ORGANIZATION OF THE STUDY*

Chapter II presents the socio-economic environment of the study area. Chapter III develops the theory of the household-firm model. Chapter IV operationalizes the household-firm theory by using a Linear Programming model (LP) and an Almost Ideal Demand System (AIDS). Chapters V and VI present the estimation results and conclusions of the study respectively.

Chapter II

THE STUDY AREA

II.1. *INTRODUCTION*

In order to trace the impact of FFW on production, consumption and income of the household-firm, it is necessary first to understand the socio-economic environment of the study area under which the FFW program was introduced. More specifically, since the interest here is modeling the household-firm, a further attempt has been made to understand the basic production and marketing structure of the area. This chapter is devoted to this purpose. First, a brief discussion about the natural environment and the population is presented. Second, the level of production in both crops and livestock and household-firm marketing behavior regarding crops, livestock and labor are examined. Third, the status of FFW programs in Kenya, and, more importantly, their initiation, implementation, and routine operation in the study area are discussed. Finally, an effort is made to see whether FFW-participant households are different from non-participant households with respect to land and livestock holdings, marketing behavior, and income.

II.2. *BARINGO DISTRICT: THE NATURAL ENVIRONMENT AND THE POPULATION*

The geographical study area is Baringo District in the Rift Valley province of Kenya, East Africa. The location of this district is

presented in Figure 2.1, and the specific research area within the district in Figure 2.2. Baringo District covers 9,885 square kilometers and is larger than most other districts in the country. A major problem in this district is that 45% of its land is either too steep or too dry for agriculture according to official land classifications (Baringo, 1983).

The total population of the Baringo District, as reported by the 1979 census, were 203,792 (102,186 female and 101,606 male). At the time of the census, only 7% of this figure lived in the study area which consists of the township of Eldama Ravine, Kabarnet, Marigat and three other small trading centers. About 93% resided in the rural part of the district and make a living from agriculture and livestock. In other words, 188,710 people live on a total area of 987,500, ha. of which only 541,600 ha. (i.e. 55%) are cultivable.[1] 176,900 ha. (18%) are suitable only for dry grazing and browsing while the remaining 269,000 ha. (27%) are classified as non-agriculture since 158,600 ha. (59%) are steep slopes, 14,400 ha. (5%) are under forest, lakes, rivers and swamps, and 96,000 ha. (36%) are used for roads and homesteads (Baringo, 1983).

The total number of households in the rural part of the district are 39,645 with an average family size of 4.76. Theoretically, there are 13.66 ha. of cultivable agricultural land per household (or 2.87 ha. per person) in 1979. In reality, however, the distribution is such that the

[1] 10 square kilometer is excluded for townships and other trading centers.

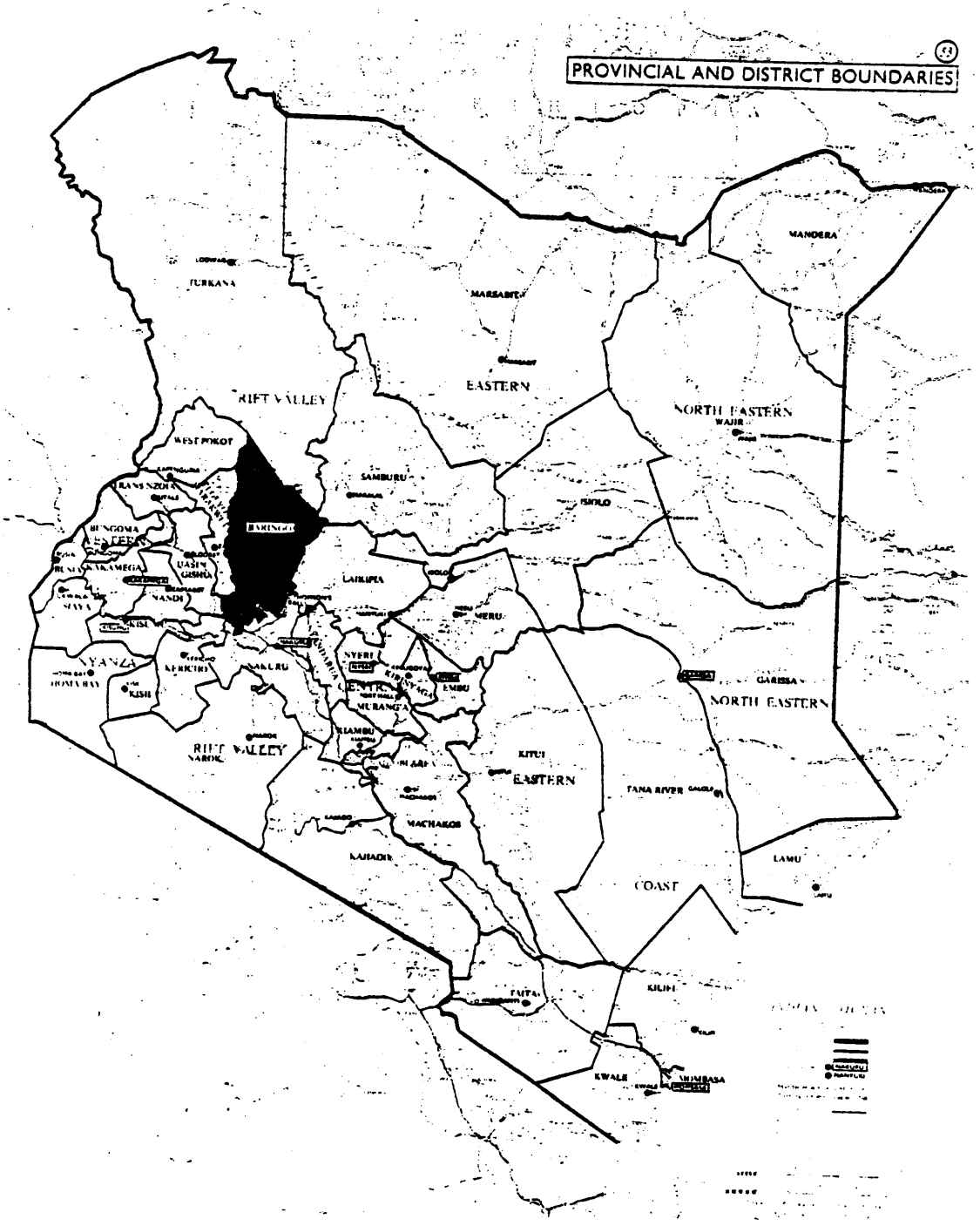

Figure 2.1 Map of Kenya and the Study Region.

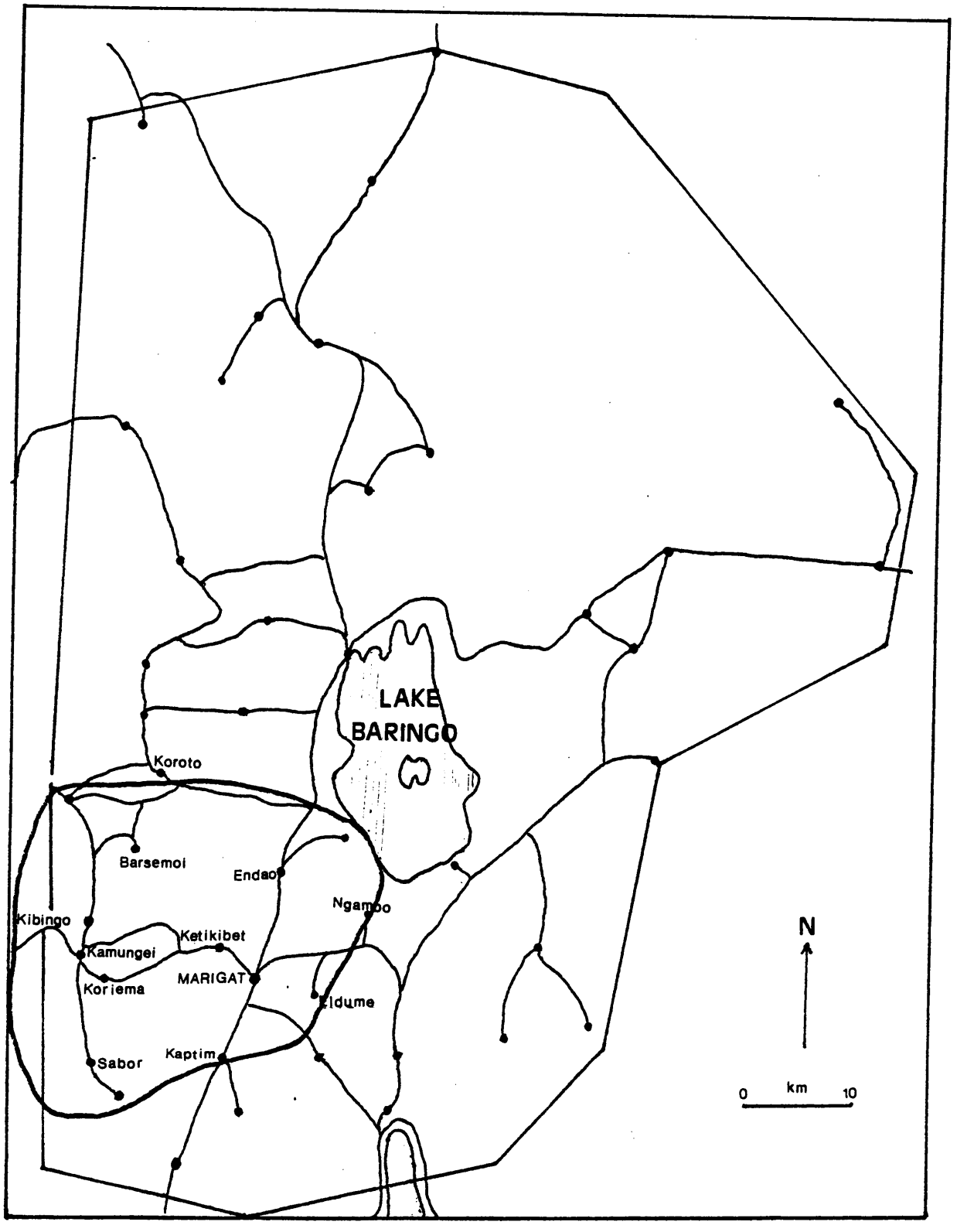

FIGURE 2.2: Baringo Pilot Semi-Arid Area Project.

cultivable areas are at a higher elevation and are densely populated. The lower parts of the district on the other hand are very dry and very sparsely populated.

The land of this district can be broadly divided into five ecological zones, upper highland (UH), upper midland (UM), lower highland (LH), lower midland (LM), and lowland (L). This classification is based on the probability of meeting the water and temperature requirements of the main crops of the District. This classification also parallels that of Braun's Climatic Zones of precipitation and evaporation index.

These five zones are again divided into subzones according to potentially leading crops (Table 2.1). The agro-ecological zones of the tropics as a whole is presented in Table 2.1. This figure helps in comparing the natural endowment of Baringo District to other districts in Kenya, and more importantly in assessing the relative position of our specific research area (LM5) within the Baringo District.

Thirty-five percent of the district is semi-arid and characterized as livestock-sorghum (UM5) and livestock-millet zones (LM5) while 15 percent of the district is sub-arid (UM4 and LM4) and classified as maize-sunflower zones.[2] Agriculture in the semi-arid zone is very marginal and risky, and in the sub-arid zone it is still considered relatively weak. In all these zones, soil erosion and degradation are

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[2] Semi-arid tropics, as defined by Troll (1966) are areas where precipitation exceeds potential evapotranspiration for 2 to 7 months of the year.

Table 2.1. Agro-Ecological Zones of the Tropics.

Main Zones / Belts of Z	0 (perhumid)	1 (humid)	2 (subhumid)	3 (semi-humid)	4 (transitional)	5 (semi-arid)	6 (arid)	7 (perarid)
TA: Tropical Alpine Zones Ann. mean 2-10° C	Glacier / Mountain Swamps	I. Cattle-Sheep Zone		II. Sheep Zone			High Altitude Deserts	
UH: Upper Highland Zones Ann Mean 10-15° Seasonal night frosts	ZONES	Sheep-Dairy Zone	Pyrethrum-Wheat Zone	Wheat-Barley Zone	U. Highland Ranching Zone	* U.H. Nomadism Zone		
LH: Lower Highl Zones Ann mean 15-18° M min. 8-11° norm. no frost	ZONES	Tea-Dairy Zone	Wheat/ Maize Pyrethrum Zone	Wheat/(M) Barley Zone	Cattle-Sheep-Barley Zone	L. Highland Ranching Zone	* L.H. Nomadism Zone	
UM: Upper Midl Zones Ann. mean 18-21° M Min 11-14°	ZONES	Coffee-Tea Zone	Main Coffee Zone	Marginal Coffee Zone	Sunflower-Maize Zone	Livestock-Sorghum Zone	U. Midland Ranching Zone	U. Midland Nom. Zone
LM: Lower Midl. Zones Ann. mean 21-24° M min 14°	* ZONES	L. Midl. Sugar-cane Zone	Marginal Sugarcane Zone	L. Midland Cotton Zone	Marginal Cotton Zone	L. Midland Livestock-Millet Zone	L. Midland Ranching Zone	L. Midland Nom. Zone
L: Lowl. Zones IL: Inner Lowl Z Ann mean >24° Mean max < 31°	* ZONES	* Rice-Taro Zone	* Lowland Sugarcane Zone	* Lowland Cotton Zone	* Groundnut Zone	Lowland Livestock-Millet Zone	Lowland Ranching Zone	Lowland Nom. Zone
CL: Coastal Lowl Z[5] Ann mean >24° Mean max. <31°	* ZONES	* Cocoa-Oilpalm Zone	* Lowland Sugarcane Zone	* Coconut-Cassava Zone	Cashewnut-Cass. Zone	Lowland Livestock-Millet Zone	Lowland Ranching Zone	Lowland Nom. Zone

* Not in Kenya.

Source: Adopted from Agro-Ecological Zones and Soil: Baringo, 1982.

the most serious problems to both farming and livestock activities. In these zones, water concentrated and run-off-catching agriculture (or irrigation), and soil conservation methods are suggested as effective means of growing competitive crops and for livestock improvement. The other lower zones such as UM6, LM6, L6 are classified as ranching zones and are unsuitable for agriculture. The best agricultural area of the district is the wheat/maize-Pyrethurm zone (LM2) and wheat/maize-barley zone (LH3). These zones, however, cover an area of only 302 sq. km. (Baringo 1983). In general, the Baringo District in relation to all other Kenyan districts is rated as a "big but poor" district. However, efforts to improve the semi-arid portion of the district are underway through the Perkerra Marigat Irrigation Scheme, the Baringo Semi-Arid Area Project (BSAAP) and Marginal Land Research Station at Marigat.

Our area of interest is Zone LM5. LM5 (Table 2.1) covers more than 300 sq. km., the largest single zone in the district, and lies between 1030-1550 meters of altitude. It has an annual mean temperature of 24 degrees C. The area gets an annual average rainfall of 655 mm ranging from a low of 376 mm to a high of 1086 mm over the last 25 years (BSAAP--Summary, 1983). It has a very short annual growing period of 45-54 days (Baringo, 1983).[3]

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[3] Growing period = life of annual plants from seed to physical maturity.

In this zone, Sorghum and Maize are normally grown with Finger Millet, the most competitive crop. Livestock of local type do well in this zone relative to the lower ranching-zone. Our specific research areas do not cover the entire LM5 area. The actual survey area is shown by a circle in Figure 2.2.

In what follows, our discussion pertains only to the actual survey area which is considered to be typical of the semi-arid zone of LM5. The data presented were collected with the aid of field enumerators and other assistants during seven months of field work.[4]

II.3. *THE ENUMERATION AREA: THE ECONOMIC ENVIRONMENT*

The research area is shown by a "circle" in Figure 2.2. It constitutes Marigat and Ewalel locations. The sub-locations within these two locations also are shown in Figure 2.2. These include Koriema, Sabor, Kaptim, Eldume, and Endao (Marigat location) and Kimodis and Kabusa (Ewalel location). These locations are part of the Tugen area and the people are Tugens, one of the ethnic groups within the Kalenjin tribe. There are 1030 households (or 2.6 percent of the rural households of Baringo District) with a mean family size of 4.44 consisting of 2.43 adults, and 1.95 children.[5]

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[4] Detail is in "Data Base: Sampling Procedure and Relevant Data Preparation" section IV.5.

[5] Adults in this study are defined as those who are over the age of 14 years.

II.3.1. *Production and Market Activities*

Production activities in this area are mainly characterized by traditional production techniques with a single production season; and by dryland farming of two types, rainfed Shamba farming and water concentrated wet season farming. The rainfed Shamba farms are those farms which are usually planted near the farmer's homestead during the wet season, once a year. The water concentrated farms are located near a river and usually are far from the farmer's homestead.

The major crop activities in this area are millet, sorghum and maize. These crops are cultivated on both types of farms once a year. Figure 2.3 presents the farming calendar for the three major crops and other crops grown in the surrounding areas. Land preparation is performed by both men and women and usually begins in February. The fields may be ploughed by hand, work animal, or some combination of the two depending on both family and farm sizes of the household. Planting follows immediately in March. Harvesting begins in June for all the three crops and ends in July for maize and in August for Millet and Sorghum (Figure 2.4).

The exact average farm size in this area is difficult to determine since most dryland farms are not individually owned. However, a rough estimate of mean farm size of 2.23 ha. was calculated from the survey. Relative to other endowments of the area, land (dry) seems to be equitably distributed. Equally as important is the fact that there

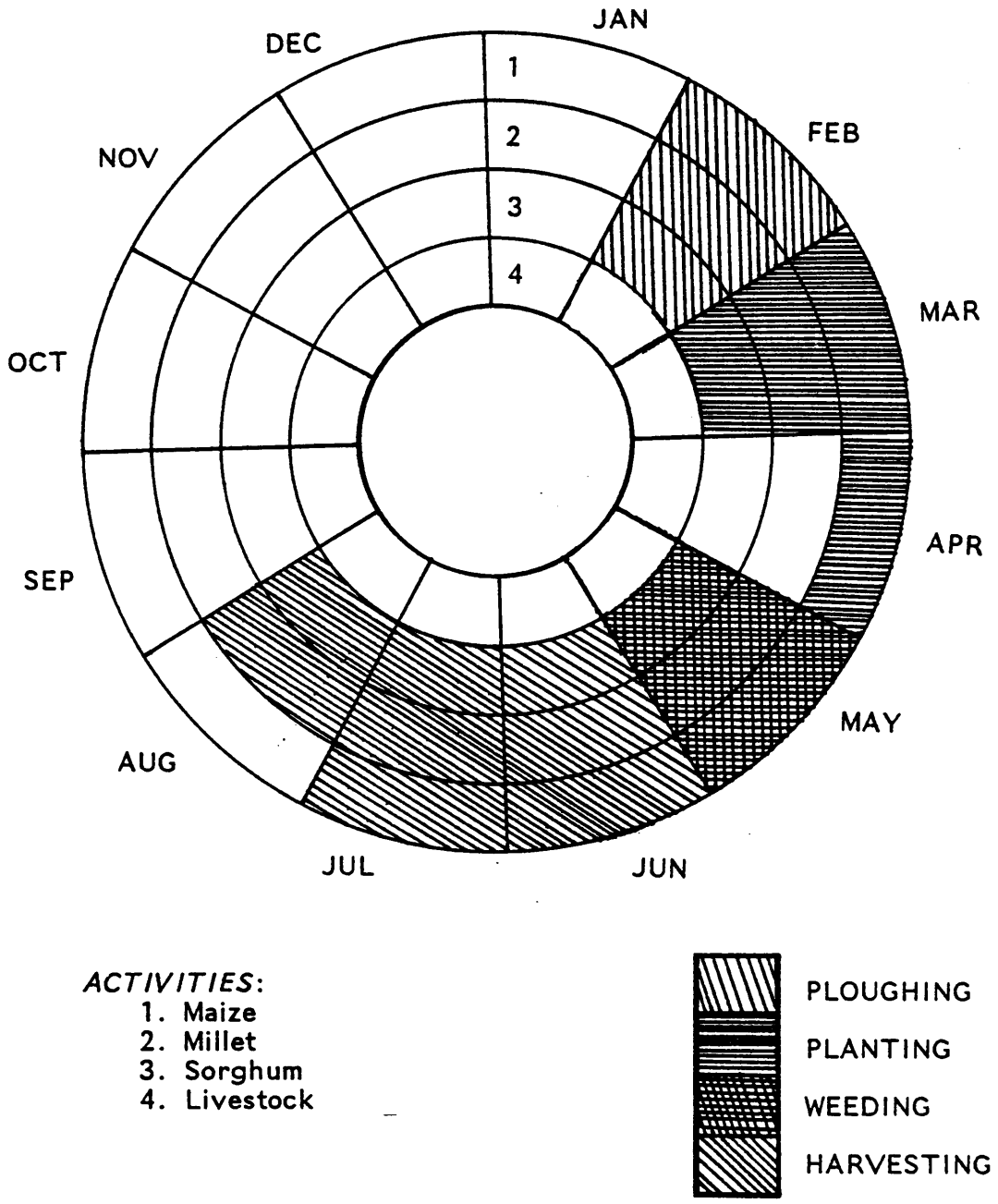
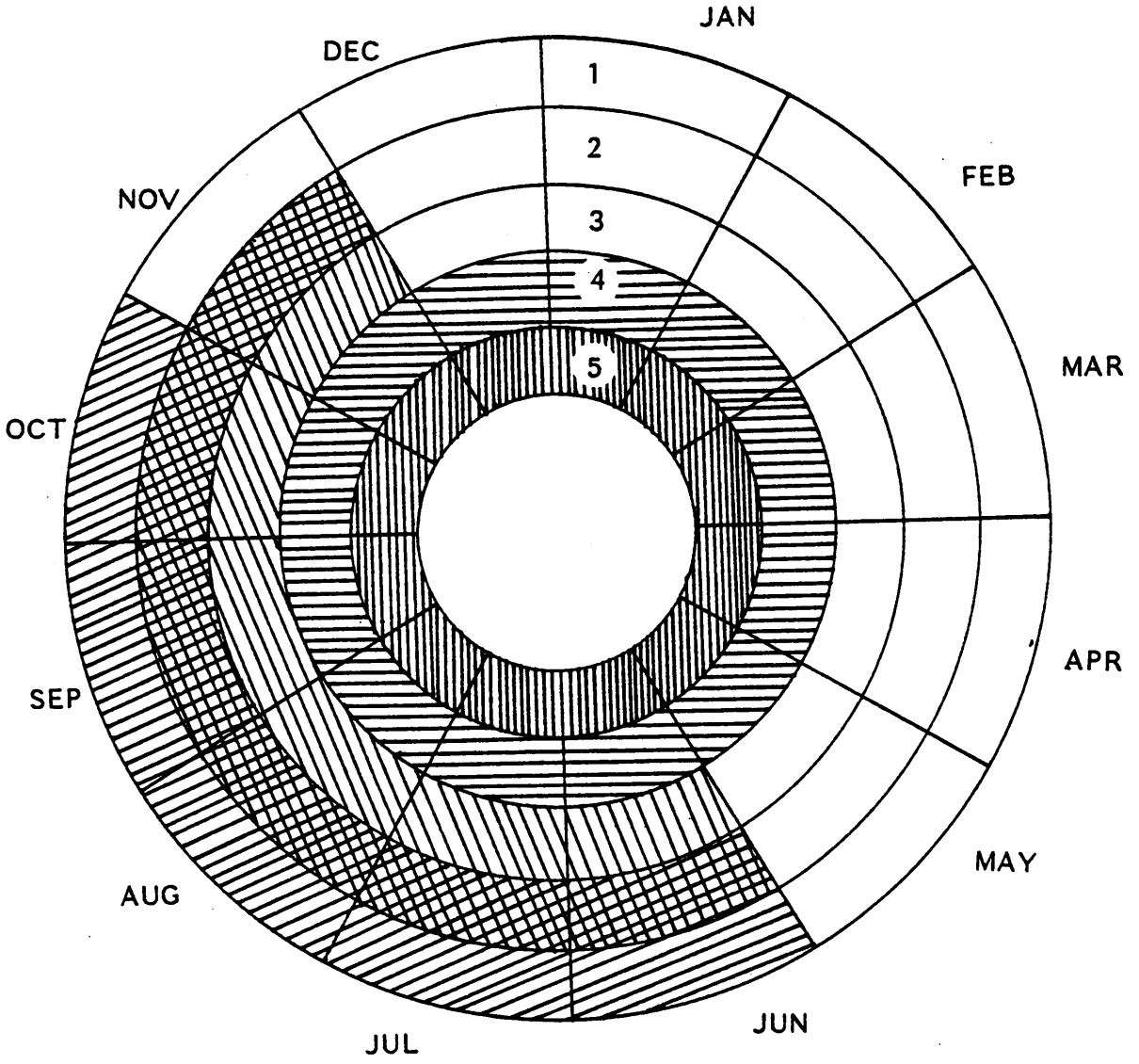


FIGURE 2.3: Food Production Calendar.



1. Maize
2. Millet
3. Sorghum
4. Milk
5. FFW: Maize
   Beans
   Oil

FIGURE 2.4: Food Availability.

are no landless households.[6] However, because of the problems associated with dryland farming and the type of land owned, not all farm households harvest all the crops that are planted. For example, during the sample period (Feb. 1983 - Jan. 1984) 12.33 percent of the farm household didn't harvest any crop at all, 33 percent failed to harvest maize, and 5 percent and 49 percent did not harvest millet and sorghum respectively. A wide range of other minor-shamba crops grown in the area include beans, cowpeas, ground nuts, and vegetables (such as potatoes, onions and chillies) which are raised during the wet season. Production yields for these crops vary greatly from year to year depending on weather conditions.

Livestock is the main economic activity in the survey area as well as the surrounding Njemps and Pokot locations. Most farm households raise traditional (or unimproved) livestock. These include goats, sheep, chicken, and cattle. Goats are of major economic importance among the livestock. There are two reasons for their importance. First, they feed on natural pasture and browse almost any plant or leaves. They adapt to the dry land environment and, hence, are less vulnerable to disease and drought. Second, because of their fast rate of reproduction and readiness for sale, owners' cash requirements for purchasing non-farm goods could easily be met in a relatively short period of time. Therefore, in this area goats are often considered as a

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[6] Out of the total sample of 300 households, 37 households (12.33%) had only common land. That is, they did not have any private (individual) land. All these households could be considered as landless for the study period since they did not harvest any crop.

source of continuous income and, hence, provide a sustainable source of security From our survey of 300 households, about 2.68 households kept a total of 7776 goats, or an average of 14 goats per households, as compared with an average of 14 sheep and 10 cattle per household. All these goats were the small East African local breed and have relatively poor dairy potential. Although they are kept mainly for meat production, they still provide some milk for home consumption. Unlike the widely held view (example Stotz, 1983), our survey shows that there is excess goat milk for human consumption, over and above the kid's suckle.

Virtually all crop and livestock activities are mainly carried out by small family farms, and the overriding motive of production is to meet subsistence family needs. Based on this requirement, farmers engage in selling and buying activities of both crops and livestock during periods of surpluses and deficits respectively. Details of the harvesting, consumption and selling activities are presented in Table 2.2(A) with the income that is generated from it by crops, while the buying behavior of the farm household is shown in Table 2.3(A). Examining these two tables leads to the conclusion that our sample households do in fact participate in the growing market transactions for both livestock and crops in the Tugen and the surrounding Njemps locations.

In discussing producers' marketing behavior in this rural area one needs to identify the type of market structures available to the

Table 2.2. Crops: Quantity Harvested, Consumed, and Sold (Kg)

Crops	Harvested: Number of Households	Harvested: Quantity/household	Consumed: Number of Households	Consumed: Quantity/household	Sold: Number of Households	Sold: Quantity/Household	Price/unit*	Average Income (Kshs)
		A) for the Total Sample Households						
Maize	201	343.12	197	117.39	86	244.97	2.05	502.19
Millet	226	191.95	205	75.58	71	125.07	3.75	469.01
Sorghum	153	108.19	110	54.13	12	168.13	2.45	411.92
Other Crops	181	228.25	159	46.45	73	385.00	5.09	1959.65
		B) for FFW-participants						
Maize	70	316.00	70	108.31	34	206.57	1.88	388.35
Millet	73	153.00	72	63.41	25	137.10	3.70	507.27
Sorghum	54	81.27	49	42.58	6	122.50	2.96	362.60
Other Crops	57	104.07	57	44.08	20	90.68	3.34	302.87
		C) for Non-FFW-participants						
Maize	131	376.30	127	128.24	52	285.85	2.12	606.00
Millet	153	209.12	133	80.84	46	120.13	3.81	457.70
Sorghum	99	117.23	61	56.37	6	252.00	2.11	531.72
Other Crops	124	302.72	102	48.52	53	530.61	5.90	3130.60

*price figures are in Kenyan shillings (Ksh)

Table 2.3. Food Products Purchased and Expenditures by Food Items

A) for the Total Sample Households

Item	Number of Households	Quantity (Kg.)	Expenditure (Ksh.)
Maize	159	42.75	81.00
Millet	132	16.31	62.70
Beans/ Sorghum	289	11.00	50.70
Other non-meat/ Dairy food	289	86.23	157.90
Meat/dairy Products	281	19.15	200.50
Non-food	300	N/A	1144.00

B) for FFW-participants

Maize	40	46.10	81.50
Millet	32	78.16	80.00
Beans/ Sorghum	92	9.17	46.60
Other non-meat/ Dairy food	92	117.70	170.00
Meat/dairy Products	93	13.50	168.50
Non-food	100	N/A	1261.40

C) for Non-FFW-participants

Maize	119	41.62	81.00
Millet	70	16.31	62.70
Beans/ Sorghum	197	11.81	52.65
Other non-meat/ Dairy food	197	71.53	152.50
Meat/dairy Products	188	22.00	216.30
Non-food	200	N/A	1028.40

N/A = Not Applicable

farm household. In Kenya, in general, there are two distinct marketing channels, formal and informal. The formal market refers to those outlet that are controlled by either export marketing boards or parastatal agencies that purchase for domestic distribution. For the most part, this channel is available only for the large scale commercial farmers. The informal market, in contrast, is the "free market" channel through which almost all of the surpluses of traditional small holders are marketed (Singh and Squire, 1983).

Producers in the study area fall solely into this informal market structure. The free market price faced by the farmer in this area may be lower or higher than the price in the formal market which is usually set by the "government" as a "floor price." Theoretically, surpluses should flow into the market channel that has higher prices until prices in both markets are equalized. However, the movement of surpluses from the formal to the informal market (say in times of higher prices in the free market) are controlled by the agencies mentioned above. On the other hand, the flow of surpluses from the informal market into the formal market might be constrained by transportation and marketing costs of smallholders. It appears that all marketed surpluses in the study area are sold through the informal local market channels.

Market channels and centers for most crops are available within the study area. Local traders buy food crops directly from the farmers at a producer price and resell them at higher prices in a distant center or township area (Little, 1981). Kibingor and Barsemoi in Ewalel

location, and Koriema, and Sabor in Marigat location are typical of small trading centers. Marigat town is the largest trading center in the area. In most cases, a member of the farm household takes family produce to the nearby center and sells it for cash or exchanges it for other necessary household items. This is especially true for milk marketing.

In the case of livestock, a more competitively organized (or informal) market channel is available at Marigat, the Marigat Livestock Auctions. In this auction both local traders and the actual individual buyers and sellers participate. Even though it was not captured in the survey, from talking with the local chiefs and assistant chiefs, it was discovered that between 20 and 30 percent of all sales in the sample area go through the Marigat Livestock Auctions. In this auction exchanging cattle for goats or sheep, especially goats for heifers or young bulls, is a common strategy among market-participant farm households. The other market channel that is available for the farm household is through stock traders based at Emening who buy and sell livestock in the area. However, this method is not as popular in the Tugens as it is in the adjacent Njemps location. The most common method for obtaining or selling livestock, however, is by purchasing from or selling to the local people themselves.

II.3.2. *Labor Utilization and Income.*

Our sampled farm households derive the major portion of their income from own-farm activities, cropping and livestock as shown

above. They also engage in wage-employment in farm and non-farm activities. A breakdown of the farm household's labor time devoted to various cash-income and non-cash-income earning activities for the survey period (Jan. 1983 to Jan. 1984) is represented in Table 2.4.

The average household spends 2240 hours per year (59 percent) of the total work hours on own farming and livestock activities, 739 hours (19 percent) on wage employment activities and 848 hours (22 percent) of work per year on non-income generating activities, (e.g., work inside own home and/or work for relatives (percent). Therefore, the average household has used a total of 3827 hours per year for work activities, of which at least 2979 hours (79 percent) a year are in the income-generating activities.[7] Throughout the year, wage employment typically varies from 1 percent of total work hours in June to 2.7 percent in December.

The income from cash earning activities is shown in Table 2.5 (A). From this table it is clear that own production of livestock is the main source of income (72 percent). Own production of crops and wage-employment produced only 28 percent of the household's annual earned income.

During the survey period, a total of 104 households hired-in labor in aggregate crop and livestock activities. The average household hired-in a total of 129 hours of labor for maize, millet and sorghum, and 137 hours of labor for livestock. A total of 209 households have

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[7] This means that each adult in the average household works 1575 hours a year (i.e. 3827 divided by 2.43 adults).

Table 2.4. Family Labor Utilization and Proportion of Households Participated in the Labor Market

Labor utilization of the average household (Mh)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Coefficient of Variation
Labor for own farming and livestock	219	137	222	203	183	210	186	193	212	119	177	179	.17
Labor for wage-employment	53	76	58	91	63	41	36	82	93	57	93	105	.32
Labor for non-income generating activity	70	76	60	59	56	66	71	58	63	57	61	42	.14
Total family labor use	342	289	340	353	302	317	293	333	368	233	331	326	.1
Proportion of Households participated in the labor market													
Households only hiring-in labor	.01	.02	.03	.04	.02	.05	.03	.02	.02	.01	.01	.01	.57
Households only hiring-out labor	.04	.06	.10	.05	.04	.08	.07	.03	.05	.04	.03	.04	.41
Households hiring-in and hiring-out labor	.00	.00	.02	.02	.00	.01	.03	.00	.00	.00	.01	.00	1.41
Total labor market participation	.05	.08	.15	.11	.06	.14	.13	.05	.07	.05	.05	.05	.47

Table 2.5. Annual Household Income by Source

Source	Income (Ksh.)* Total (000)	Percent of Total	per household	Labor Used (Mh) Total** (000)	Productivity (income/Mh)
A) For the Total Sample Households (N = 300)					
Own production:					
Sales of crops	130.6	12	435	110.7	
Value of own consumption	158.4	15	528		
Total	289.0	27	963		2.61
Sales of livestock and livestock products	619.3	59	2064	328.4	2.00
Wage-employment	123.3	12	411	83.3	1.50
Other	18.6	2	62	not available	
Total	1050.0	100	3500	522.4****	2.00
B) For FFW-participants (N = 100)* **					
Own production:					
Sales of crops	29.9	11	300	31.8	
Value of own consumption	48.0	17	479		
Total	78.0	27	779		2.44
Sales of livestock and livestock products	162.3	58	1623	87.4	2.00
Wage-employment	34.3	12	343	26.8	1.30
Other	5.4	2	54	not available	
Total	280.0	100	2799	146.0****	1.92
C) For Non-FFW-participants (N = 200)					
Own production:					
Sales of crops	100.7	15	503	78.9	
Value of own consumption	110.4	17	551		
Total	211.1	32	1055		2.67
Sales of livestock and livestock products	339.4	52	1697	240.9	1.41
Wage-employment	89.0	14	445	55.9	1.60
Other	13.3	2	66	not available	
Total	652.8	100	3263	375.7****	1.74

* Gross Income.

** Figures in this column exclude labor used from relatives (or community). Although information on hours obtained from other sources (i.e. besides family and hired) were collected, it was felt that these data were unreliable. Thus, family labor supplied to relatives were not subtracted as well.

*** Information in this section does not include income from participation in FFW. Thus, sections B and C could easily be compared.

****Does not account for labor time spent on other activities that generated "other income".

sold labor for wage for various farm and non-farm activities. This suggests that the sampled-farm households did participate in the labor market through both selling and buying labor services during the survey period.

Labor demand peaks in March when all three crops are being planted. September,October, November, December, and January are the slack months as far as cropping activity is concerned. However, livestock activity occurs throughout the year, and labor requirements for herding during the dry season (September through March) tend to increase considerably. For example, the average annual labor requirements for the dry season for both cattle and goats is 300 and 256 hours respectively while the average hour requirements for the wet season (April, May, June, July and August) are only 116 for cattle and 73 for goats. The reason is that livestock are usually taken to swamp areas which are far from the homestead for watering and grazing during the dry season. It also should be noted that cattle herding is done by those household members between the ages of 7 and 14 during the wet season while herding is done by males over the age of 14 during the dry season. Therefore, livestock requires relatively more adult labor in the dry season than in the wet season (Little, 1981). Thus, some portion of the slack labor time with respect to cropping will be taken by the increased demand for herding and watering livestock. The dry season is also the period in which the farm household spends considerable time rebuilding or repairing the physical facilities of the homestead (e.g. fencing, roofing, etc.) (Little, 1981).

The exact slack periods of the seasonal fluctuations of family labor use within the calendar year, from January 1983 to January 1984, could not be determined. Instead, following Barnum and Squire (1979), the degree of fluctuations of family labor use in income as well as in non-income generating activities was tested. The coefficient of variation for each activity is shown in Table 2.3. The coefficient of variation for own production (crops as well as livestock) is 0.17. This low coefficient of variation indicates that the total family labor use in own production activity is not subject to significant fluctuations. Therefore, we may be able to assert that the slack periods or the off-crop months might have been used for livestock activities which, as shown above, demand more labor time during the off-crop months (dry season). The other coefficients of variation, 0.32 for wage employment and 0.14 for non-income generating activities also indicate that these activities are not subject to either the peaks of livestock or cropping seasons.

It has already been established that farm households participate in the labor market in the area. In subsistence areas such as the Tugen location, however, some farm households may not participate in either labor selling or labor buying. In order to test this possibility, one could examine the coefficient of variation of the proportion of households that participated in the labor market as presented in the bottom half of Table 2.4. The coefficient of variation of 0.47 for the total labor market participation is low, suggesting that labor market

participation is not very seasonal. However, the coefficient of variation of hiring-in and hiring-out, 1.41, is very high and indicates that this activity is quite limited. It is also important to note that the coefficient of variation for hiring-in labor, O.57 is higher than the coefficient of variation for hiring-out, O.41. This confirms our belief that since the majority of farm households have "shambas" of 0.9 ha. or less and a family size of 4.44, it is possible that family labor could be adequate. It also confirms the widely held view that hired labor in dry land farming is limited (see for example, Little, 1981). However, this is not evidence to deny the area from being classified as a "market oriented area."

The information presented above about the economic environment of the research area suggests the following: (a) own farm activities (crop and livestock) are the major income-generating activities of the area. (b) the households are active participants as either sellers or buyers in the market for both farm products and labor, and hence, (c) part of household income is generated from cash-wage-employment although it is possible that a small proportion of the household's income may be spent on hired labor.

The study period for this research was considered to be a typical year, i.e., it was neither good nor bad with respect to its average rainfall. Thus, the picture painted about the area, based on our data, should more or less reflect average yearly conditions.[8]

[8] This information was from personal discussions with the crop, soil, and range specialists of the Baringo Pilot Semi-Arid Project at

In the following section we present a brief discussion about a major developmental project in the area that may well have affected the household's level and rate of production, and the pattern of household consumption.

II.4. *BARINGO PILOT SEMI-ARID AREA PROJECT AND FOOD FOR WORK PROGRAM*

The Baringo Pilot Semi-arid area project (BPSAAP) is a World Bank project that began in early 1980 (World Bank Report No. 7635-KE, 1979).[9] This project is an integrated rural development project designed to build-on or expand the existing government's activity in the area (Lewis, 1983). It is coordinated from a community (village) in the center of the project area, Marigat-town.

As the name of the project suggests, the BPSAAP was an experimental- pilot project designed to produce a field tested approach that will be used as a basis for developing not only the district of Baringo but also other semi-arid areas in the country. The pilot period (or first phase) was designed to last three years. The lessons learned from this phase were supposed to be integrated into the overall development plan thereby producing a workable framework for semi-arid areas as a second phase. This phase was planned to begin in 1984.

Marigat.

[9] We do not make distinctions between BPSAAP and BSAAP since the latter is to contribute to the former by ensuring that nutrition considerations are built into the overall planning process of BPSAAP. The BSAAP is implemented by the GOK/FAO and started in 1982 (Kwofie, 1983).

The overall guideline of the project design was based on Schumacher's idea of using local resources for local use (Schumacher, 1973). Since labor is the abundant resource of the area, labor intensive techniques were the basis for all participant government bodies or ministries in designing their respective project activities (World Bank, 1980). Although the Ministry of Agriculture and Livestock Development coordinates the overall project activities, there are six other ministries responsible for implementing a number of components of the project.[10] The major components of the projects that are being implemented include: soil and water conservation, crop development, livestock and range development, water development, social service and community development, small scale rural craft industries, education, health and tree nurseries (or forestry). A more detailed discussion about each of these components can be found in BPSAAP, *Work Plans and Budget 1983/84* (December 1982).

The project area covers approximately 5,000 sq. km. which is about 40 percent of the Baringo District, with 53,000 people (or 23 percent of the district), of which about 10 percent are in our survey area. Figure 2 shows the total project area.

This discussion is not intended to provide a detailed analysis of BPSAAP, but rather to establish the background under which the Food for Work (FFW) project was introduced and implemented in the area.

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[10] Ministry of Agriculture, and Ministry of Livestock Development are now combined to form Ministry of Agriculture and Livestock Development since September 1983.

Before presenting a detailed discussion about the FFW project in the BPSAAP, a brief discussion of the UN/FAO/World Food Program (WFP) which exclusively supports the FFW projects in Baringo District is provided.

II.4.1. *World Food Program in Kenya*

The World Food Program (WFP), upon the Kenyan government's request, is involved in a number of rural development projects and famine relief services in different food-deficit areas, mostly arid and semi-arid areas, of the country. Although the method of operation in each project differs, the new driving force (or the exogenous input) of all these projects is food committed from the WFP. It is important to note that the WFP is only involved through the food it provides as a project input. Hence, success or failure of any type of WFP-supported project heavily depends on other domestic/local supportive-material inputs including project/program personnel and an overall program policy. In the case of Kenya, the Government of Kenya (GOK) is responsible for implementing all the above projects by providing the necessary personnel and any additional financial inputs which include both storing and transporting the food from Mombasa (Port of Kenya) or from any other origin in the country to its final destination (WFP, 1982).

The bulk of food items currently provided to WFP-supported projects in Kenya are maize, beans, and vegetable oil. Maize and beans are obtained (purchased) by WFP from Kenya while the oil is imported.

More specifically, Kenyan maize and beans are provided by the National Cereals and Produce Board (NCPB) of Kenya to WFP for which WFP gives NCPB an equivalent value of wheat which is imported (WFP, May 1982). Thus, the NCPB is responsible for making the maize and the beans available to the WFP-projects at the nearest NCPB store. NCPB is also responsible in transporting the oil from the port of Mombasa to the NCPB store in Nakuru. The total commitment of WFP to various projects, as of May 1982, is extracted from *Summary of WFP Current Projects in Kenya (May 1982)*, and presented in Table 2.1 (Appendix A).

II.4.2. *WFP Within the BPSAAP*

The FFW project within BPSAAP is a WFP-supported rural-development project, identified as "Baringo Soil and Water Conservation Project," started in the latter part of 1981.[11] The project was designed to utilize 800 workers per month on conservation activities within the BPSAAP by paying food for labor. The introduction of FFW projects into the BPSAAP was to accelerate and to reinforce the on-going integrated rural development activities of the BPSAAP. With this intention, most participant ministries use food as a wage payment (sometimes referred to as food rations) to participant workers within their respective components.

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[11] This name is misleading since food is used in all other components as well.

Usually, each project authority within BPSAAP identifies a project site under a specific component within their jurisdiction that justifies the use of food rations. This justification includes ad hoc budgetary information, the number of people (or man/days) required and the estimated length of time for the project. This information is presented to the coordinator of BPSAAP through the Water and Soil Conservation Department, which is directly responsible for all WFP-supported projects in the BPSAAP. The project coordinator may send a copy of the final proposed work to WFP/Nairobi, not for approval but only to inform the headquarters. The decision of whether to use food rations in a particular site for a particular work-activity during a particular period of time is made at the project site by individual specialists, local technicians, and the coordinator of BPSAAP at Marigat. Of course, this decision depends on WFP budget for that particular year which is made available to local project authorities in a prior year, as indicated in Table 2.1 (Appendix A).

It is this approach, namely the bottom-up project design that appeals to people at the project site. Project coordinators (Mr. N'geno and Dr. Lewis), and other area specialists and field technicians, for example (Mr. Chepkwony, Mr. Chesumbai, and Mr. Mania), believe and have supporting evidence that involving WFP and BPSAAP was an important factor in its success. One of the major contributions of food from WFP has been to support those components that have been affected by the national treasury budget cutback (for example, those labor

intensive components such as crop production and soil and water conservation). In general, they argue, the flexibility and the "power" that WFP allows the on-site decision makers (i.e. local project designers and coordinators) to exercise in the use of its food, provided it is used as an input in development projects, is a break-through in the pattern and impact of using outside aid in the study area. In line with this view, the Soil and Water Conservation specialist, Paul Chepkwony, wrote, "WFP has been very flexible about the different activities on which the food is used as long as the activities have had a bearing on development." (Paul Chepkwony, 1983, p.5). WFP requires only regular monthly and quarterly reports on progress as well as an accounting of food utilized. Hence, all the components utilizing the WFP ration (FFW) have to report on types, amount of work done, and work rates with the number of workers involved, to the Soil and Water Conservation Department which in turn reports to WFP/Nairobi.

II.4.3. *Food Collection and Distribution*

As discussed earlier, the food (maize, beans and oil) is made available to the project at the National Cereals and Produce Board in Nakuru which is the nearest store to the BPSAAP region. These items are collected periodically by the Soil and Water Conservation Department of BPSAAP on behalf of the WFP/Nairobi. The NCPB then invoices the WFP for the value of food drawn (only for maize and beans). The amount of maize, beans and oil released by NCPB at Nakuru as of October 1983 is shown in Table 2.2 (Appendix A).

Usually, the amount of food needed by the project, not necessarily the amount of food released, is brought to the Marigat Agricultural store for monthly distribution to the participant-workers in the field.[12] As of the end of September 1983, 662.62 mt of maize, 42.56 mt of beans, and 27,000 liters of oil had been used in the project area since the project began in late 1981 (Chepkwony, 1983).

Monthly food utilization for the study period for the BPSAAP and the study area is presented in Tables 2.4 and 2.5 (Appendix A) respectively. From these tables, it is observed that 69 percent of maize, 58 percent of beans, and 49 percent of oil had been utilized in our study area.

The detailed work done in the specific location and the man/days each activity required with the actual number of monthly participants is presented in Table 2.5 (Appendix A). From this table one could observe that the output of these FFW projects are communal or public in nature (see under column "Type of Work"). One could also observe the total man/days used for each month as shown in Table 2.6 (Appendix A) so that the "high" and the "low" months for the FFW activities could be identified. This has an important implication for our study since these activities may interfere with own farming activities. For example, April seems to be the peak month for FFW activities followed by November, June, October, and December, in that order. April and

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[12] Sometimes the food collected from NCPB is distributed directly to the workers since the Marigat Store cannot accommodate more than 120 bags of food at any given time.

June may cause conflicts with own production activities since, as discussed earlier, these months are planting and harvesting periods respectively. Also, we expect households to increase their participation in the FFW projects during those periods in which food (i.e., maize, millet and sorghum) is in scarce supply in the area (this might be December through May), and reduce their participation during the time of food surpluses (this might be June through November). This expectation appears to be inconsistent with the data reported in Table 2.6 (Appendix A) (for example, see January and February, and June and November).

Our data indicate that FFW activity is spread throughout the year (see Table 2.6). In fact, more than 50 percent of the FFW-participant households participated in every month except November, December, and January. It is less seasonal (coefficient of variation 0.30) than even wage-employment (coefficient of variation of 0.32) in the area. On the other hand, this might be an indication that FFW participants, in general, do not have access to other factors, besides their own labor, to produce the main local crops, maize, millet, and sorghum. However, before accepting such a strong assertion, one should compare participant with non-participant households through the major resource indicators of the area and the overall characteristics of the households. This point is discussed in section II.4.4.

Every participant-worker receives maize, beans and oil adequate for a family size of five for a month in the following proportion:

Table 2.6. FFW Participation by Month

	Proportion of Households Participated	Number of People Participated	Total Participation (Mh.)
Jan.	0.44	50	1000
Feb.	0.53	61	1220
March	0.65	78	1560
April	0.66	79	1580
May	0.69	82	1640
June	0.61	70	1400
July	0.67	78	1560
Aug.	0.69	81	1620
Sept.	0.67	80	1600
Oct.	0.62	75	1500
Nov.	0.34	38	760
Dec.	0.28	32	640
coefficient of variation	0.30	N/A	N/A

Source: Survey

Maize = 45 kg.
Beans = 4 kg.
Oil = 1.5 kg.

or daily ration of 2.25 kg. of maize, 0.2 kg. of beans, and 0.075 kg. of oil.[13] The average food receipt, in the study area, for the study period was calculated from Table 2.6, and is shown in Table 2.7. The average household received 1809 kgm. of maize, 161 kgm. of beans, and 60 kgm. of oil.

II.4.4. *Who Participates in FFW Projects?*

As pointed out earlier, FFW is designed to promote the welfare of the very poor through direct employment. This, of course, requires selection criteria with respect to who can and can not participate in FFW activities, a very difficult task. In the case of FFW projects in the BPSAAP, there are no such criteria. Hence, the approach is "first come--first serve"; and the main thrust of the program is based on the belief that FFW activities will only draw upon a residual labor force not engaged in either own-activities or in any other wage-earning activities at the time of participation. The other point usually made for not having a set of criteria is the idea that participation in FFW activities indicates a lower social status in a community. Hence, it is only the very poor who are likely to participate.

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[13] All participants are adults and most of them work from 8 a.m. to 1 p.m., twenty days per month. Most of them participate at least once a month.

Table 2.7. Average Food Receipts from Participation in FFW and the Income It Generates

Month	ITEM			
	Maize (Kgm)	Beans (Kgm)	Oil (Kgm)	Income-equivalence (Ksh.)*
Jan.	112.5	10.0	3.7	274.70
Feb.	137.2	12.2	4.6	335.60
Mar.	175.5	15.6	5.8	428.70
Apr.	177.7	15.8	5.9	434.20
May	184.5	16.4	6.1	450.70
June	157.5	14.0	5.2	384.70
July	175.5	15.6	5.8	428.70
Aug.	182.2	16.2	6.1	445.60
Sept.	180.0	16.0	6.0	440.00
Oct.	168.7	15.0	5.6	412.20
Nov.	85.5	7.6	2.8	208.70
Dec.	72.0	6.4	2.4	176.00
Total	1808.8	160.8	60.0	4419.80

Source: Survey

* In converting food receipts into cash-income, maize was evaluated at 1.85, beans at 4.25, and oil at 6.50 ksh. per unit.

In order to examine the veracity of the above trusted belief, with respect to our research area, we chose the following factors:

(1) Households characteristics (Table 2.8) (2) Average size of land holdings (Table 2.9) (3) Average number of livestock holdings (Table 2.10) (4) Production activities (Table 2.2 (B & C)) (5) Purchasing activities (Table 2.3 (B & C)) (6) Income and labor productivity (Table 2.5 (B & C))

In each of these tables, participant were compared with non-participant households. While there are no noticeable differences between participants and non-participants in terms of age-sex composition one would observe some differences with respect to years of education (see Table 2.8). Also, the average land size for participants (6.6 acres) is relatively less than the non-participants (8 acres) as shown in Table 2.9. However, when the land is classified by type, except for pasture land, one cannot draw an interpretative difference .

The average household's livestock holdings by type of livestock is depicted in Table 2.10. From this table, it is not clear that FFW-participant households are different than non-participant households. One may observe, however, that non-participant households have more goats per household than participants, and non-participants have more cows and cattle per household.

Production, consumption from own production, and selling activities of participant and non-participant households are presented in Table 2.2 (B & C). From this table, it is clear that the average

Table 2.8. Summary of Characteristics of Sampled Households

Indicators	FFW-participants	Non-FFW participants
Average age composition of Households (years)		
under 15	2.17	1.84
15-64	2.42	2.44
over 64	0.02	0.07
Percentage - male	51.19	50.69
Percentage of total persons by education levels (years)		
no education	60.52	65.00
1-5	30.00	22.60
6-8	8.67	10.67
9-12	0.65	1.50
more than 12	0.16	0.23

Table 2.9. Average Size of Land Holdings by Types of Land

Type of Land	FFW-participants (N=88) Average land size (acres)	Non-FFW participants (N=175) Average land size (acres)
All Land	6.59	7.95
Good or Cultivable Cropland	2.03	2.27
Poor Cropland	3.45	3.01
Pasture or Other Land	1.11	2.67

Table 2.10. Average Number and Types of Livestock Per Household

FFW-Participants

Types of Livestock	Number of Households	Before FFW	With FFW
Goats	88	24.45	28.31
Sheep	48	15.23	14.56
Cows and other cattle	75	13.53	12.93

Non-FFW Participants

Types of Livestock	Number of Households	Before FFW	With FFW
Goats	180	31.24	36.10
Sheep	93	13.75	17.37
Cows and other cattle	158	8.94	11.24

harvest of participant households is less than the average harvest of non-participant households for all crops, and much lower for sorghum and "other crops" (column 3). As a result, the average consumption from own production, the average quantity sold, and income generated from cropping activities is significantly lower for participant households. One could also observe that non-participants tend to have a relatively diverse cropping pattern. For example, the average harvest for other crops, which includes all crops and vegetables except maize, millet and sorghum, was 302 kgm. for non-participant as compared to 104 kgm. for participant households.

The purchasing behavior of participant and non-participant households are shown in Table 2.3 (B & C). The total average purchase for all food items for both participants and non-participants is 265 kgm. and 163 kgm., respectively. The largest difference between these two groups of households is in millet and other non-meat/dairy food items. While the average participant household purchases 78 kgm. of millet and 188 kgm. of other non-meat/dairy food items, the non-participants' purchase of millet and other non-meat/dairy food items is 16 kgm. and 71 kgm. respectively.

Labor productivity (i.e., income divided by hours of work) is shown in the last column of Table 2.5. While labor productivity of non-participant households is 2.67 in crop production, 1.41 in livestock production and 1.60 in employment, the productivity of labor for participant households is 2.44 in crop production, 2.00 in livestock

activity, and 1.30 in employment. As a result, a total labor productivity of 1.92 for participants and 1.74 for non-participants is observed. The only difference between these groups worth noting is that participants' labor productivity in livestock activity is higher than that of non-participants'.

Total livestock holdings are compared before and after participation (Table 2.10). In this table, figures under "Before FFW" represent holdings before participation, and figures under "With FFW" represent after participation. Here, too, it is not clear whether participants are different from non-participants.

Finally, and most importantly, the two groups of households are compared by income from all sources (Table 2.5 (B & C)). The major source of income for participant households is livestock activity (58%) while the least is wage-employment (12%). Crop activities contributes 27 percent of total income. For non-participant households, livestock is also the main source of income (52%) while the least is also wage-employment (14%). Crop production contributes 32 percent.

In order to examine the pattern of income distribution before FFW, participants and non-participants were grouped separately by income quintiles. Each quintile ($Q_1,\ldots,Q_5$) is 20 percent of the total sample. The quantities are developed by first arraying households from lowest to highest income (i.e. Q_1 representing the lowest 20 percent income group and Q_5 representing the highest 20 percent income group). The relative mean income (RMI) was calculated for each

quintile by expressing the mean income of each quintile as a proportion of the mean income of the total sample. This measure (RMI) has been suggested by Solow (1967) for evaluating income distribution. This comparison is presented in Table 2.11.

Although participants in the lower three quintiles of the income distribution had slightly higher incomes than non-participants, their RMI's were almost identical for Q_1, Q_2, and Q_3 reflecting no apparent difference between the three income groups. In other words, low income participants appear to have almost identical incomes to non-participants before income derived from FFW is introduced. The RMI was decidedly higher, however, for non-participants in Q_4 and Q_5, suggesting either that higher income families tend not to participate as much in FFW because of status or that their income from other income generating activities is relatively higher than income from FFW. This suggests that the lowest income groups participated relatively more in FFW than high income groups. It is clear also that not all families in the lowest income group in the area participated in FFW.

In summary, the data presented above seem to suggest the following:

(1) The average harvest of crops of participant households is much less than the average harvest of non-participant;

(2) On the other hand, the average purchase of food items of participants is high relative to purchases of non-participants;

Table 2.11. A Comparison of Incomes by Quantiles for FFW Participants (excluding the value of food received from FFW) and Non-Participants.

	Participants (N=100)		Non-Participant (N=200)	
Quintiles	Income	RMI	Income	RMI
Q1	826	.26	798	.26
Q2	1579	.51	1525	.49
Q3	2474	.79	2277	.73
Q4	2918	.94	3640	1.17
Q5	6193	1.99	8080	2.60

(3) Participant households seem to be relatively more productive than non-participants in livestock activities.

(4) Finally, participants have less income (excluding income from FFW) than non-participants.

Thus, at this stage, one could only suggest that the FFW program seems to reach those households with low income.

II.4.5. *Habit Formation of Participants*

In a program such as FFW, the notion of habit formation must be considered since it usually means introduction of "new" food for consumption into the local economy. This is nothing more than asking the question, would participants adjust to the new food-item distributed instantaneously or with some time lag or not at all? This, of course, depends on the closeness between the new food-item and their own diet. In our study area, both maize and beans are part of the local diet. As mentioned earlier, maize is the staple grain, and locally produced while beans are usually purchased from Marigat and/or other vegetable centers within the area. It is only oil that seems "new" to the average participant household's diet. Developing taste for the oil may only be a matter of days since information on how to use it and its nutritional benefits are provided (or at least available) by the Ministry of Health (through community health workers) and Ministry of Culture and Social Service (through the Family Life Training Center). The other point to note is that since participant households can either sell or consume any item received from participation, the length of time required to develop

tastes for the oil received is less important. The recipients can sell any amount of oil not consumed. As a result, they do not have to consider their consumption habits in order to make a decision about their participation time in FFW projects. Hence, participant households may acquire food in excess of own consumption.

Our data reveal that only 12 percent of the households have sold some of the food aid received, while 15 percent have exchanged it for other food items. However, 73 percent of the households have consumed all of it.

Chapter III

THE CONCEPTUAL FRAMEWORK

III.1. *INTRODUCTION*

Because this study is concerned with exploring the impacts of food aid/FFW programs on FFW participant households, it is necessary to analyze micro-data relating to both consumption (goods as well as leisure) and farm production of household-firms. Impact analyses of food aid at the macro level have been covered extensively elsewhere (e.g., Bezuneh and Deaton, 1981; Blandford and Von Plocki, 1977; Dudley and Sandilands, 1975; Hall, 1980; Mann, 1967; Rogers, Srivastava and Heady, 1972; Seevers, 1968). This study, however, attempts to disaggregate the impact of food aid/FFW at the household level to understand what an exogenous injection of an additional resource, such as FFW, means to production and consumption decisions at the farm-household level. In this chapter, a model is developed that integrates the microeconomic effects of FFW.

III.2. *THE FRAMEWORK*

A non-market, or targeted approach such as FFW is hypothesized to affect both production and consumption decisions simultaneously. Incorporating the theory of agricultural household behavior in a peasant household-firm model (HFM) is one conceptual approach for simultaneously addressing consumption and production effects. Although the general approach to the analysis of agricultural households

is traceable to Chayanov (1966), Nakajima (1969), Sen (1966), and Hymer and Resnick (1969), recently there have been numerous studies which have contributed to the theoretical and the empirical development of the HFM (Yotopoulos and Lau, 1974, Barnum and Squire 1979, Ahn and *et al.* 1981; Strauss, 1982, 1984a, 1984b). The basic HFM analytical approach consists of four elements: a household utility function, a production function, and income and time constraints. This framework is general enough to allow not only the integration of consumption and production for a single crop (Barnum and Squire, 1979) but also for households producing multi-crops as well (Ahn, *et al.* 1981, Strauss 1982).

The overall attractiveness of this framework lies primarily in removing the assumption of independence between production and consumption decisions and avoiding the traditional approach of treating income as an exogenous determinant of consumption. The use of such an assumption becomes less defensible when analyzing production-consumption decisions in subsistence and/or semi-subsistence economies where demand and supply decisions are embodied in the same household. The dual nature of the farm household, as a producing firm and as a household, means that both production and consumption decisions are interdependent and, hence, must be treated jointly. Consider, for example, a change in the price of agricultural output. According to the traditional assumptions of consumer behavior, a change in price will affect the consumption of all goods and leisure via its

substitution and income effect. On the other hand, when households are classified as only producers, a price change will affect output, profit, and thereby net household income. In this case, consumption and production decisions are separable. However, for households in a semi-subsistence economy, both consumption and production decisions are embodied within the same household since households produce goods as well as consume them.[14] Thus, price changes will directly affect both households' consumption patterns through price induced substitutions in consumption and profit from own production. Therefore, farm households have a joint response to price changes, as producers and as consumers. It is this dual behavior of the farm household in subsistence economies that introduces a high degree of complexity to the traditional analysis of consumption and production which subsequently led to the development of HFM.

This model integrates production and consumption activities under a single framework by recognizing the farm household as a firm which attempts to maximize profits (or net income) from own production subject to a given technology (or production function), and a given set of endowments, on the one hand, and as a household (or consumer) which maximize utility from own consumption of agricultural output as well as the consumption of non-agricultural outputs including leisure subject to a given income (or budget) constraint on the other. As a result, joint determination of household consumption of goods (own as

[14] Note also, decisions on the supply and demand of labor are made by the same farm household as well.

well as market) and leisure, supply and demand of labor, and the use of other resources are possible. It should be noted that the use of this framework (HFM) requires the explicit assumption that consumption decisions are not separable from that of production. However, production decisions, given an active labor market, usually are assumed to be independent of consumption decisions. All the empirical work that utilized this framework have argued that farm household decisions can be modeled in a strictly block recursive manner (Yotopoulos and Lau, Barnum and Squire, Ahn *et al.*, Strauss).[15] This implies that households first make production decisions according to a set of goals (e.g., meeting subsistence requirements, profit maximization), and then given these goals determine the optimal level of consumption of goods as well as leisure that maximizes utility. However, this assumption may not hold up if farm households are actually equating subsistence production with own subsistence consumption, and their goal is only meeting own consumption needs.[16] This, of course, would have required the model of the farm household to be specified as a simultaneous one. It is this joint treatment of production and consumption of the model that separates HFM from the traditional production and consumption approaches.

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[15] All these studies have assumed that the outcomes of household decisions are known with certainty, and hence, risk was not considered.

[16] In general, farm households have motives above and beyond meeting own consumption.

This framework is particularly appropriate to the analysis of FFW since FFW is an exogenous shock to the rural economy, and is usually designed specifically to affect both production and consumption decisions simultaneously. For example, consider an injection of food aid in terms of FFW into a rural economy. On the consumption side, the amount of sale or purchase of farm output of the participant household will change. This in turn will affect price and, hence, farm output, farm profit and total household income. On the production side, the impact of the injections by the FFW program are directly traceable through labor supply and newly created assets (inputs).

Being a participant in the FFW program requires a change in the amount of household labor supplied for sale as well as for own farm activities. The allocation of household time to different labor activities may be examined by looking at the time available to the farm household, the total of which is absolutely fixed, at least in the short run. Time is allocated into labor for wage, labor for own production and leisure. The infusion or introduction of FFW activity into the economic system must of necessity cause a change in the pattern and amount of time allocated to each of the above activities.[17] Following the change in household time allocation, there will arise changes in own farm output, which in turn affects household income and consequently changes the consumption pattern of the peasant household.[18]

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[17] Labor time may also be allocated to relatives or communities for various implicit benefits.

[18] Wage rate and commodity prices may become sensitive depending

The effectiveness of food-for-work programs in expanding output and employment will depend upon not only the pattern of household time allocation, but also on the extent to which the food-for-work activity draws into production idle or underemployed resources, labor in particular, and upon the extent to which the productivity of these resources is increased. In other words, it also depends on the extent to which FFW projects are capable of creating or producing new (or additional) productive assets of significant magnitude to initiate a further impact on farm output.

More importantly in this study, time allocated for own production, for wage, and leisure "with" and "without" FFW will be investigated in relation to labor supply, supply of farm products, purchase of market goods, and other household characteristics. For example, if labor time spent in FFW projects is in addition to what the household could have worked otherwise (i.e., if the time allocated to FFW projects comes solely from either off-season time or leisure), assuming zero opportunity cost for these time periods, the household, unambiguously, enjoys a gain in food availability. That in turn can be used to either increase marketed goods or decrease market purchased goods which, in either case, leads to an increase in household income.

While it is possible to state without ambiguity that household income will increase when all the resources in the FFW activities come from idle resources, when the resources used come from those employed

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upon the magnitude of the injection (i.e. food aid).

in other productive activities, the effect of FFW on household's income is indeterminate *a priori*. One can argue that if participants in FFW projects are voluntary, as they are, that the expected net return from participation must be higher than the actual earnings of the participants from alternative activities. However, in the real world there is no assurance that *a priori* expectations will be realized. One explicit hypothesis to be tested will be that participant households' net income will be higher than if they had not participated. If, however, participants have the choice to participate but didn't participate, that does not necessarily mean that participation does not yield a higher net return relative to other activities. It may just be that potential participants are risk averse. The fact that FFW programs represent new or different types of activities may increase the risk perceived by potential participants and pose a possible barrier to participation.[19]

Analyzing the impact of FFW projects on participant households as well as on non-participants (or the community in general) is further complicated by the fact that all project effects are not felt at once and, hence, require both short-run and long-run analysis. A graphic presentation of a peasant-household's production and expenditure (or consumption) system is shown in Figure 3.1. As argued, it is possible to capture the effects of FFW programs in the short-run through the allocation and pattern of household labor supply, as indicated by an

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[19] Here, the variability is not in terms of the value received from FFW but rather on the length of time that a participant could be allowed to participate.

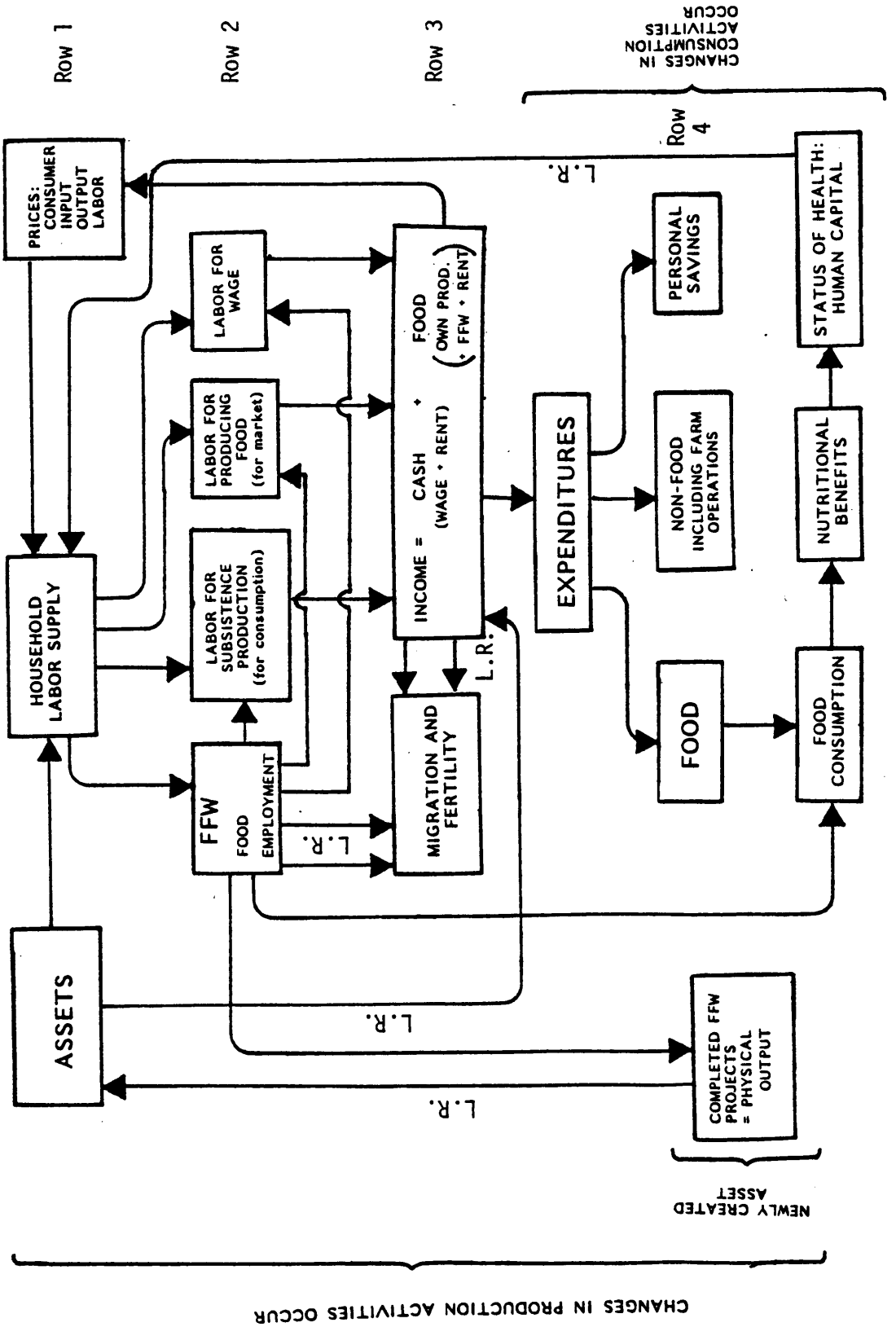

FIGURE 3.1: SCHEMATIC REPRESENTATION OF HOUSEHOLD'S PRODUCTION AND EXPENDITURE (OR CONSUMPTION) SYSTEM.

arrow (→) starting from the second row in Figure 3.1. All the arrows (→) except those with L.R. (long-runs) indicate the causal relationships that can be captured (or determined) by a short-run analysis.[20] However, the long-run impact of FFW is not only traceable through the allocation of time by participant households but also through its asset creating potential as shown by the extreme left portion of the diagram (L.R.). While it is possible to argue that the benefits (or costs) of the program in the short-run are reaped primarily by participant households and the community at large, identifying who reaps the long-run benefits (or costs) is less clear. This is because these benefits are likely to be more closely related to the type of output being produced (e.g. roads, irrigation, water well, school buildings, clinics, etc.) and, more importantly, to the structure and distribution of asset ownership. In this regard, two points are important. One, who owns the assets created by the project? The long-run benefits to participant households will be minimal from creating privately owned assets for others. Second, those households who own inputs that are complementary (e.g. land) with those outputs from FFW (e.g. irrigation) will inevitably benefit more directly than those households without such resources. In other words, the increase in income from FFW for those households with inputs (or assets) is expected to be higher than those without. This is because the former is expected to

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[20] Short-run analysis, in this study, is defined as analysis that only captures the effects of exogenous change for one single agricultural production cycle (i.e. 12 months).

employ all or some of the additional inputs that are created by FFW projects in their farming operation. Hence, for example, Income (Y) for landholding households can be written as:

$$Y = NY + WY + FY$$

Where NY is profits from farming which depends, among other things, on the newly created assets of FFW; WY is wage income, and FY is direct income from participation in FFW projects. For the landless households, however, NY is zero.[21]

Therefore, it is important, both from the standpoint of theory and of policy to distinguish the impact of FFW projects on these two types of households, which we will call, for simplicity, landed and landless households.[22]

As discussed above, FFW projects affect both production and consumption decisions. Therefore, the overall effect of FFW injection can only be assessed by appealing to a model that integrates the decision making process of the farm household with respect to production and consumption behavior. In the following section, the theoretical model of the farm household is specified.

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[21] Note that landed households do not have to participate in order to derive indirect benefit from FFW projects.

[22] Landless households are those households who do not produce any food crops for either their own consumption or for sale since these households neither own nor rent land for farming. Landed households are those households who produce one or more crops from either their own land or rented land within a single agricultural production cycle.

III.3. *THE THEORETICAL MODEL*

Our unit of analysis is the household, both FFW project participants and non-participants. These households are assumed to be semi-subsistence farm households (as discussed in Chapter II), that is, households who produce and consume goods, and sell or buy the difference. They also sell a part of their family labor and hire labor from outside the household. Households are assumed to allocate their available resources so as to maximize a utility function (U) of the form:

$$U = U(L, Q_i)$$

where: L = consumption of leisure time

Q_i consumption of good i, i = 1, ...,n.

The Model assumes that households attempt to allocate their monetary budgets and time in such a way as to maximize utility subject to budget and time constraints. The implicit assumption is that farm households are rational decision makers and always, given all their resource-endowments, strive 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 upon as a means to expand the opportunity set of the participants in terms of time allocation. This is to suggest that the introduction of FFW programs expands the number of productive activities from which the household may choose. To the extent that the time allocation pattern of participants changes in response to the availability of the FFW projects, the budget constraints

of participant households will change. For each participant in the FFW program there is an implicit cash equivalent wage rate corresponding to the bundle of food distributed from FFW so that the participant is indifferent between being paid in food and being paid in cash. Thus, the household first determines the allocation of its available time between leisure and various production activities (including FFW programs) so as to maximize its utility subject to constraints imposed on the household. Hence, the household, taking prices and wages as given, decides to allocate its time and other resources to different production activities and leisure. After allocating time and other resources, the household will make consumption decisions based on the observed budget constraints (consumption will be assumed to not require time or to be incorporated in leisure time).

Participants will be drawn to work in FFW projects when the utility of participating in the FFW project exceeds the value of the opportunity cost (including opportunities for the allocation of time) for participation. The household then maximizes its utility in consumption subject to the derived budget constraint.

FFW projects, when completed, will alter the production relationships on local farms and possibly the marginal productivity of labor. This in turn is expected to alter the wage rate and the "cost" of leisure. The optimal allocation of time between different types of labor and leisure will change. In particular, FFW may result in the relaxation of the capital input constraints facing the households. This

results in part from the attribution of the FFW projects to the landed households (as indicated by the extreme left hand portion of the schematic diagrams in Figure 3.1).

The effect of FFW is hypothesized to be primarily a substitution for both leisure and work time at home and, in addition, is expected to affect farm work time for households with land as well. The total time available for FFW depends to a large extent on the person's employment status outside the home and ownership of assets, land in particular. This suggests that the households' work time in FFW projects may depend not only on the food wage rate but also on the amount of cultivated land that a household owns since the opportunity may exist to improve the productive capacity of the farm. It is expected that the landless participant will allocate relatively more work time in FFW projects than those who have land (landed household). The model, thus, focuses on the determination of the allocation of time to different competing production activities and thereby traces out the impact of these allocations on farm output and income, and total expenditure on different commodities (including leisure).

For our purposes, the multi-crop framework of Ahn, *et al.*, and Strauss will be followed since, in reality, it is very rare to find subsistence or near-subsistence farm households with a single crop.

The participant household's utility function is assumed to be a function of own consumption of agricultural outputs, consumption of various market goods, consumption of food obtained from participating

in FFW programs, and consumption of leisure. Those goods that are solely produced by household labor and used only for own consumption, since there is no market for such goods (in the literature such goods are often referred as Z goods), are implicitly entered in the model. Commodities are produced using the conventional inputs of labor, land, and capital. Here, however, we make a distinction between capital without the FFW projects (k) and capital with the FFW projects (I^k) which is the net addition to capital endowment as a result of FFW projects. This component is entered separately into the production function as physical capital (I^k_{t-1}) while the human capital component (i.e. the level of skill learned from participating in FFW projects plus better work performance from additional nutrient intake from FFW) is assumed to be captured in the labor input. The household's time constraint is assumed to equate total time available to four uses: leisure, work in own farm productions, work for wage, and work in FFW projects.[23] Finally, a participant household faces a budget constraint which equates total cost in production and consumption to total or full income (using Becker's concept of full income) from selling labor and farm products (when there is excess of own consumption), and income from other sources.[24]

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[23] Assumptions and constraints concerned with the production side of household behavior will be dropped when modeling landless but participant households.

[24] Full income in Becker's sense incorporates the value of time.

Our model is a short run or a single production period model which is simply the duration of one agricultural season. Hence, the total land and fixed capital available for a particular household is assumed to be fixed. We also maintained the traditional assumption of decision certainty by appealing to the time period of analysis. For a single agricultural cycle, the assumption is made that both production and consumption decisions are made, and thus, their consequences are said to be known with certainty at the time of those decisions. Households are assumed to be in a market environment, and hence participate in selling and/or buying activities of both product and labor. It is assumed that input and output prices and wages, regardless of the unit of payment (cash or food), are exogenous to the household decision makers.

With these observations in mind, an analytical model of the farm-household that draws on the foregoing theoretical arguments will now be presented. The households modeled are of two types: landed and landless. First, two multi-crop models for landed non-participant and participant households are developed (Model I). Second, a similar model is specified for landless participant and non-participant households (Model II).

III.3.1. *Model I: Non-participants*

The basic household firm model is formulated as follows:

$$U = U(C_i, M_i, L) \qquad (3.1)$$

$$F_i = F_i(D, A, K) \qquad (3.2)$$

$$T = V + D + L \qquad (3.3)$$

$$q_i M_i = W(V) + Y + P_i(F_i - C_i) - W_k d_k \qquad (3.4)$$

where:

U = utility of individual household

L = leisure (i.e., discretionary time used in neither farm production nor off-farm activities)[25]

C_i = own consumption of agricultural output i (i.e., food consumed within the household itself)

M_i = consumption of market purchased good i (i.e., agricultural and manufactured goods that are purchased for household consumption)

F_i = total agricultural output of good i by farm household

D = total labor used in F_i production

K = capital used in F production (fixed and variable) = $K(K_{t-1}, S_t, d_k, B_t)$

where K_{t-1} = available capital inputs at the beginning of production period

S_t = own saving during the production period

B_t = borrowing during the production period

d_k = other variable inputs

A = land used in F production

d_k = other variable inputs used in F production

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[25] Leisure in this model is defined as a residual and includes both voluntary leisure, involuntary unemployment, and off-season slack time resulting from the seasonal nature of agricultural production.

T = total time available to a household

V = net quantity of labor sold (or purchased if negative) for wage

Y = income from exogenous sources (i.e., non-wage including FFW, and non-crop)

W = wage rate

q_i = price of M_i

P_i = price of F and G

W_k = price of d_k

All the arguments in (3.1) represents the aggregates over all household members and over one agricultural production cycle, one year.

III.3.2. *Model I: Participants*

A multi-crop model that integrates FFW into the basic HFM model, when participant households are considered, may now be specified as:

$$U = U(C_i, M_i, G_i, L) \quad (3.5)$$

$$F_i = F_i(D, A, K, I^k{}_{t-1}) \quad (3.6)$$

$$T = V + D + J + L \quad (3.7)$$

$$q_iM_i = W(V) + Y + P_i(F_i + G_i - C_i) - W_kd_k[26] \quad (3.8)$$

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[26] The specification in (3.8) evaluates the food received under FFW at the existing market price. Alternatively, food received could have been evaluated at the existing wage rate, and the appropriate specification would have been: $q_iM_i = W(V) + Y + P_i(F_i - C_i) + W_GJ - W_kd_k$

where the participant household's utility functions (U) are assumed to be a function of own consumption of agricultural outputs (C_i), consumption of various market goods (M_i), consumption of food from FFW programs (G_i), and consumption of leisure (L). Agricultural goods (F_i) are produced using conventional inputs of labor (D), land (A), capital (K), and capital (fixed or variable) generated from FFW projects lagged by a single production cycle, i.e. one year (I^K_{t-1}). The vector of total time endowments (T) of a participant household is assumed to be allocated to wage labor (V), own farm labor (D), FFW labor (J), and leisure (L).

Finally, a participant household faces a budget constraint (eq. 8) which equates total cost in production and consumption to total or full income from selling labor and farm products (when there is excess of own consumption) and income from other sources (Y). The variables in (3.8) are prices of market goods (q_i), prices received from farm output and FFW when sold, or prices paid when purchased (P_i), prices of labor when sold for wage (W) and (W_G) when households participate in FFW projects or implicit wage rate, prices of variable inputs (W_k), and variable inputs (d_k). The main thrust of this approach is that non-participant households will maximize (1) subject to (3.2), (3.3), and (3.4), while participant households maximize (5) subject to (3.6), (3.7) and (3.8).

G_i is defined as different commodities received under FFW programs. Even though in our model it is treated as purchased food,

the means of purchasing it is "time" instead of money, and it is assumed to yield utility that is different from C_i and M_i. More specifically, its separate introduction into the utility function is based on the assumption that food under the FFW program (G_i) is not a perfect substitute for either food from own production (C_i) or consumption of market purchased goods (M_i). It is possible that whenever the commodity under FFW, say wheat, is either identical or a perfect substitute for own production or market purchased goods of agricultural output, again say wheat, the above assumption could be dropped. In this case, for example, C_i and G_i, i = wheat, would be summed, and only their total would enter the utility function in the form of:

$$U = U(L, X_i, M_i)$$

where:

$$X_i = C_i + G_i$$

However, the items under G (maize, beans and oil) are mutually inclusive (see Chapter II), and hence would not be perfect substitute for any single commodity considered in (3.5). Hence, we kept the assumption that goods distributed under FFW are not identical with that of either own production or market purchased goods, and the relevant utility function for participant household is as shown in (3.5).

III.3.3. *Model II: Landless Households*

In this study, we also model landless households since it has been argued that the FFW program might be relatively more attractive to the landless than to the landed households.

As discussed previously, it is quite possible that a portion of households, the landless, may not produce their own crops at all. In this case, total consumption must be purchased and total household labor must be sold. Therefore, the effects of FFW on the landless participants can be determined by standard consumer demand theory, since landless households are solely consumers and are not affected directly by the production argument (3.2). The landless families are assumed to allocate their available time so as to maximize their utility. Formally, the landless non-participant households will maximize:

$$u_i\ (L,\ C_i,\ M_i) \qquad (3.9)$$

Subject to:

$$T = V + L \qquad (3.10)$$

and

$$q_iM_i = W(V) + Y + P_i(C_i) \qquad (3.11)$$

While landless participant households maximizes a utility function of the form:

$$U_i(L,\ C_i,\ M_i,\ G_i) \qquad (3.12)$$

Subject to:

$$T = V + J + L \qquad (3.13)$$

and

$$q_iM_i = W(V) + Y + P_i(G_i - C_i)^{27} \qquad (3.14)$$

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[27] As in Model I (participants), when food received from FFW is evaluated at the market price, the appropriate equation will be (eq. 6). However, when the food is treated as an implicit wage, the appropriate specification will be in the form of: $q_iM_i = W(V) + Y + W_G(J)$.

where all variables are as defined earlier.

The empirical specification of the above theoretical model is presented in Chapter IV.

Chapter IV

EMPIRICAL MODEL

IV.1. *INTRODUCTION*

A linear programming (LP) specification is used for the production segment of model I while the consumption segment of models I & II is specified econometrically using systems of demand equations. In this chapter, both of these segments are specified and a discussion of the data base used in their estimation is presented; but first previous empirical models are briefly reviewed.

Two general approaches are possible for estimating a household firm model (HFM). First, one can assume that production and consumption decisions are made jointly and estimate production and consumption systems simultaneously. Alternatively, one can assume that parameters of the demand side do not affect but are affected by parameters of the production side. In other words, one can assume that farm household decisions are block recursive. In this case, net income (or profit) from production activities is independent of consumption decisions. Farm households can be assumed to first make production decisions according to profit maximization behavior, and then to determine the optimum level of consumption subject to the outcome of the first decision. In this case, separate estimation of production from consumption can result in consistent estimates. The production side of the system is estimated first and the consumption side second after

incorporating the estimated income (or profit) from the production side. This is the approach taken in this thesis.

IV.2. *PAST EMPIRICAL SPECIFICATIONS*

The first empirical work in estimating the Household-Firm Model was by Lau, Lin and Yotopoulos (1978). On the production side, they estimated an aggregated agricultural output using profit and input demand functions. Their data were from Taiwan. The result was then used to estimate a Linear Logarithmic Expenditure System for three aggregated commodities (agricultural commodities, non-agricultural commodities, and leisure) on the demand side. The System was estimated using seemingly unrelated regression. Even though the commodities were highly aggregated, this work set the stage for further empirical development.

Barnum and Squire (1979) used a Cobb-Douglass production function to estimate the output of a single agricultural commodity, rice, and input demand for labor. Their analysis was based on cross-sectional data from Malaysia, and exhibited price variation only for labor. On the demand side, they estimated a Linear Expenditure System (LES) for rice, nonagricultural goods and leisure. The estimates for the LES parameters were obtained by ordinary least squares. In recent years, this work has been criticized for its specification of the LES and for the procedure used in obtaining the estimates (Strauss, 1981).

Ahn, Singh, and Squire (1980), using cross-sectional household data from South Korea extended the previous studies. By using linear programming model on the production side, they were able to disaggregate farm outputs into three commodities (rice, barley, and other farm produce). The consumption side was specified using an LES, and the estimation procedure was identical to that of Barnum and Squire.

Strauss (1981, 1982, 1984a, 1984b), using cross-sectional data from rural Sierra Leone, estimated output supply and labor demand functions using a Constant Elasticity of Transformation and Cobb-Douglass production functions. Since price was variant by region, he was able to estimate the price effects on six outputs, five foods (rice, root crops and other cereals, oils and fats, fish and animal products, miscellaneous foods) and non-food. On the demand side, he estimated a system of seven commodities (the same as those used on the production side and for estimating household labor supply) using a Quadratic Expenditure System with demographic variables. Strauss' system was estimated by numerical maximum likelihood techniques. This specification is an improvement over previous works since it uses multiple output production functions, a more realistic framework for most farm households in Third World countries. This procedure, however, is very data intensive and expensive in terms of both research and computer time.

The use of a simple production function as in Barnum and Squire limits the number of output supply estimates needed. The use of profit functions or output supply and input demand functions (such as used in Strauss), aside from being expensive, require price variation by households for both output supply and input demand functions. Our price data are relatively invariant and the outputs are multiple. Thus, in this study, a linear programming specification was used for the production side. Although the LP procedure uses highly restrictive assumptions (e.g. proportionality of activity levels to resources, single-valued expectation), it has a number of attributes that are attractive, particularly, to this study.[28] These are:

1. Commodity disaggregation - LP easily handles multi-crop case in an economy influenced by more than one technology. This is crucial for this study since the interest here is to model an economy characterized by at least four farming activities (maize, millet, sorghum, and livestock) under two technologies (see Chapter II). More importantly, our data do not exhibit price variations for the supply and input demand of these activities, and hence other types of production functions cannot be used.
2. It easily handles the problem of allocation of resources to competing activities and accounts for specialization since it is a deterministic model.

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[28] One disadvantage of LP is the fact that "normal" statistical tests cannot be performed.

3. For the purpose of this study, an LP model can be used to trace out the impact of FFW over time. This is because FFW is expected to affect income via labor in the first year, and production (outputs) in the subsequent years. In this case, a multi-year LP model could be considered.
4. Finally, it is easy to conduct sensitivity analysis with LP, and it is relatively inexpensive to use. The choice of LP over non-linear programming was made because of its computational cost advantage.

The demand side of the model is specified using the Ideal Demand System (AIDS) of Deaton and Muellbauer (1980). Examples in the literature of empirically estimated AIDS models can be found in Deaton and Muellbauer (1980), Ray (1980, 1982), and Capps, Tedford and Havlicek (1983). Deaton and Muellbauer estimated eight commodities on British time-series, National Account data (1954-1974). Ray (1980) extended the system by explicitly recognizing household size. He estimated nine commodities using Indian budget survey data (1957-1976). Ray (1982) extended his earlier work by disaggregating the data to consider several households. He then used pooled cross-sectional data and estimated the demand for four commodities for rural and urban sectors; Capps, Tedford and Havlicek, using the 1977-78 Nationwide Food Consumption Survey data of United States, estimated the demand for four commodities, and they also were able to extend Ray's work by including household age-sex composition in the AIDS system.

The results of these studies suggest that the AIDS system is consistent with the use of known household budget data, simple to estimate, and mostly avoids the need for non-linear estimation. Other specific advantages of the AIDS specification, particularly to this study, are discussed in detail in Section IV.4.

IV.3. *SPECIFICATION OF PRODUCTION -- THE LP*

This section presents the linear programming (LP) specification for the production side of the empirical model. The discussion is divided into two parts. The first provides an overview of farm household production behavior. The second section presents the specific LP model, the tableau, and its detailed components.

IV.3.1. *Household Production Behavior - An Overview*

> Most of the people in the world are poor, so if we knew the economics of being poor, we would know much of the economics that really matters. Most of the world's poor people earn their living from agriculture, so if we knew the economics of agriculture, we would know much of the economics of being poor.
>
> Schultz, Theodore W. "The Economics of Being Poor." Nobel lecture, December 10, 1979, Stockholm, Sweden.

Numerous studies have been written on the production behavior of peasant-farm households in all parts of the Third World countries (for example, Schultz, 1964; Mellor, 1963 and 1969; Sen, 1966; Nakajima, 1969; Krishna, 1962; Collinson, 1972; Khatkhate, 1962; Lipton, 1968; Dillon and Anderson, 1971; Hopper, 1965; Wolgin, 1975; Barry, 1977). The key issue discussed in all these studies is whether farm households

in subsistence economies respond to price changes in accordance to the economic efficiency and profit maximization principles. In this regard a number of hypotheses have to be tested, of which two are relevant here:

1. Subsistence farmers respond to price changes (see, for example, Krishna, 1962).
2. The marketed surplus of subsistence farmers is negatively related to price changes (for example, see Neumark, 1959; Khatkhate, 1962).

While the former hypothesis is self-explanatory, the latter requires some elaboration. The basis of this hypothesis is the assumption that subsistence farmers have nearly fixed demands for cash income; that is they must procure a target income level in order to meet fixed monetary obligations (for example, purchases of essential items, taxes, rents, etc.). Hence, subsistence farmers would be prone to produce more when the price of their output falls, and would be induced to produce less when price rises. Thus, the responsiveness of subsistence farmers to price changes is centered around the subsistence level.[29]

The question of whether subsistence farmers are responsive to price changes (first hypothesis) has now become widely accepted in the affirmative. The degree of responsiveness, however, depends on factor endowments of farmers, such as land, labor and capital; and

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[29] This argument parallels the "limited aspiration model" of Mellor in which subsistence requirement was treated as the main driving force for labor productivity (Mellor, 1963).

institutional factors, such as, knowledge, agricultural policy, etc. For example, in the face of a higher price increase, it is possible to find farmers' supply response to be insignificant. This should not be taken to signify non-response to price changes, but that farmers' production decisions may have been constrained by access to better inputs, improved technologies and factor proportions. The everyday decisions that subsistence farmers make on what to produce and how to dispose of output is evidence that their production decisions are influenced both by these constraints and by product prices as well. The behavior of subsistence farmers in the study area described in the previous chapter is no exception. Thus, we accept this hypothesis and provide no further discussion. However, the second hypothesis needs to be examined more closely, since a part of it will be accepted in this study.

This hypothesis can be divided into two parts; farmers' behavior up to the "target income" or up to some level of consumption requirements, and farmers' behavior beyond it. The former means that if farmers' income is below what the farmers consider to be a minimum income that guarantees a "culturally defined"-minimum consumption requirement, farmers will be forced to produce more even when the price of the product they sell falls. Hence, lower prices will not lead to reductions in output. This decision, to increase food production despite a lower price, may appear inefficient but certainly can be rational on the part of the farmers. However, the implication of the latter portion of the hypothesis is that a price increase will lead to

lower output since this enables farmers to meet their minimum requirements at a lower level of output. This latter argument is not accepted in this study. Given the limited income-generating activities, other than own-production, that a farmer faces in subsistence sectors of the economy, it would not be surprising if farmers increased their production in spite of a decrease in prices so as to achieve some level of minimum requirements. However, once these minimum requirements are achieved, one can expect farmers to produce less (more) when price falls (rises). Evidence to the contrary argument is not supported by our survey data or by other studies with which the author is familiar (see, for example, Mabele, 1974).

Two types of objectives or motivations that guide farmer behavior in a subsistence economy are identified in the literature. First and foremost is the survival motivation or the desire to procure a minimum level of staple food. Having met this objective, there is the maximization-oriented motivation. The maximization of potential surplus income or simple profit maximization falls into this category (Collinson, 1972; Low, 1982). These objectives are accepted in this study since they were observed to be consistent with households' farming behavior in the study area as well as in the adjacent BPSAAP area (Chapter II). As discussed earlier, the integrated rural development projects of BPSAAP and FFW projects in the area were a recognition of these dual objectives of the farm households; and these projects represent attempts to support farm households' efforts in the realization of these objectives.

Much of the debate in the literature has centered not so much on whether a farm household has one or two objectives but rather, given the dual nature of the objectives, on how to specify an empirical model that operationalizes these objectives (Fisk, 1975; Wolgin, 1975; Low, 1982). One question is whether the standard model of profit maximization is appropriate. Fisk disagrees with studies that apply the same theoretical tool to both subsistence production to meet basic requirements (objective one) and surplus production that is marketed (objective two). He argues for separate treatment up to the point where the semi-subsistence farm household acquires its essentials of life from cash income generated from either wage labor or cash cropping subsistence production. Berry agrees with Fisk. She suggests that in describing poor farmers' behavior in a subsistence or semi-subsistence economy, models such as "safety first," "mean variance," and/or any other form of "survival algorithm" must be utilized rather than models that assume farmers are simple profit maximizers. More recently, Low has suggested that crops grown for own consumption should be evaluated separately using the notion of "use value" or opportunity labor and purchase costs instead of market or sale value which, he argues, are necessarily different.

Here, although our general approach is consistent with models of maximization, as implied by objective two, an explicit attempt is made to address those concerns implied by objective one. Farm households in the study area, or in any area of rural Kenya for that matter, grow

part of their staple food requirements as well as purchase or sell some of it, which is consistent with the two objectives above (see, for example, Lugogo, 1980, 1983). This dual purpose of production is reflected in the production system of the farm household presented in Figure 4.1.

As discussed earlier in Chapter II, the basic production technology in Marigat-Ewalel locations is the traditional type which mainly utilizes a hand-hoe, other simple implements, and own seed. Working animals (e.g.. oxen), improved seed, fertilizer (except manure from own animal), and plant protection are seldom used. Family labor is the main variable input in this system. Some farm households, however, may hire-in labor. Even though land seems to be in abundance in Marigat-Ewalel locations, the actual cultivated land area that a farm household possesses is quite limited. Thus, the farm family (as shown in figure 4.1) using its own available inputs produces subsistence crops and livestock. The surplus subsistence crops, livestock and livestock products are sold to generate cash income. This cash income is spent on basic consumer goods and farm tools. For a number of farm households, a small portion of the cash income might be used for hired-in labor. Generally, savings in this area are very low.

This behavior, therefore, requires that the empirical production model of this study incorporates farm households' first objective of obtaining a minimum-requirement of basic food before attempting to maximize net income (or profit). This is easily handled since our

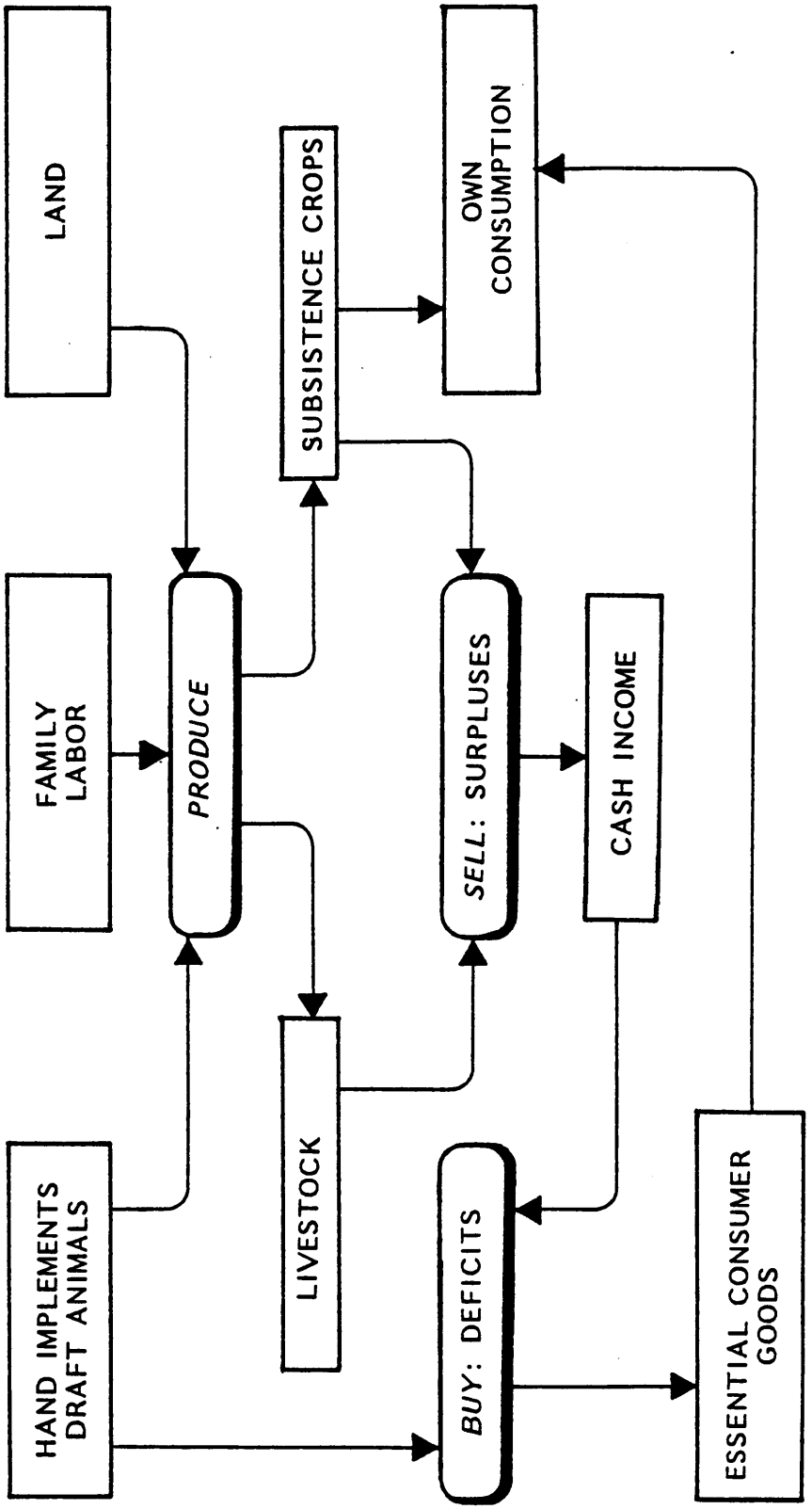

FIGURE 4.1: A Schematic Model of Subsistence Farm-Household in Ewalel and Marigat Locations.

production model is a linear programming (LP) specification. This requirement for the representative farm family, as measured in caloric-intake, is included in the LP basic plan. Table 4.1 depicts these requirements for the average family size of 4.44. Having met this requirement, the household then attempts to maximize net income.

There is also a debate on the definition of basic (or subsistence) requirements. Mellor (1963) points out that subsistence requirements may be more than biological needs. He contends that these needs are, for the most part, culturally defined. Mellor's point is well taken with respect to our study area where a farm family appears to continuously define his (her) minimum level of requirements with respect to neighbors or surroundings, thereby attempting to keep-up and maintain a minimum level of income that provides not only biological requirements but also essential ceremonial expenditures that insure minimum status and security within the community. However, this crucial conceptual point poses difficulty for empirical work. In this study, an attempt has been made to include this objective by including a minimum expenditure of 630 Kshs. for the representative farm households in the LP plan as part of the basic requirements.

IV.3.2. *Formulating the Linear Programming Tableau*

In this study, a two-year linear programming model is developed. The objective of the LP model is to determine the farm household activities that maximize income subject to available resources and minimum subsistence requirements.

Table 4.1. Food Value of the Three Subsistence Crops and Oil, Milk, and Meat with Nutritional Requirements for the Average Family Size of 4.44.

	Calories	Protein (gram/kgm.)	Fat (gram/kgm.)	Carbohydrates (Includes Fiber) (gram/kgm.)
Maize*	357	94	42	736
Millet	341	104	40	716
Sorghum	342	103	29	744
Oil	900	0	1000	0
Milk	79	38	48	54
Meat	122	746	38	0
Beans	111	109	3	229

Ages of Family Member	Number in Age Group	Protein Weighted Grams Per Day	Fats Weighted Grams Per Day	Carbohydrates Weighted Grams Per Day
0 - 5	1	40	40	170
6 - 14	1	60	60	105
15 - 60	2	150	150	818
60 +	0	0	0	0
Total per day		250	250	1093
Total per year		91250	91250	398945

*96% extraction

Source: FAO, Food Composition Table for Use in Africa, Rome, 1968.

The general LP model specification is:

Primal	Dual	
Maximize C'X	Minimize B'Y	(4.1)

subject to

$AX \leq B$,	$A'Y \geq C$,
$X \geq 0$	$Y \geq 0$

where

C is an n x 1 vector of prices

X is an n x 1 vector of activities

A is an m x n matrix of technical coefficients

B is an m x 1 vector of resource endowments

Y is an m x 1 vector of shadow prices

In this section the basic information utilized in this LP model is described. This information which includes a matrix of activities and resource constraints is presented in the form of an LP tableau (Table 4.2).

The activities of the representative farm households that are included in the model basically fall into four classes:

1. crop production, 2. livestock production, 3. participation in FFW projects, and 4. hire-in labor. There are a total of 96 activities.

The crop activity includes maize, millet, and sorghum. Each of these crops are included with two technology levels, crops grown under traditional technology and crops grown under low technology. The

Table 4.2. Aggregated LP Tableau for Participant Households.

	Year 1													Year 2												
	CP	CS	CC	LP	LS	LC	FR	FS	FC	LT	HL	BO	SA	CP	CS	CC	LP	LS	LC	FR	FS	FC	HL	BO	SA	ET	RHS
Obj.Fn.	-C	C		-C	C			C			-C	-C		-C	C		-C	C			C		-C	-C	C	1	Max
Year 1																											
Resource Con.	A			A			A				-1																≤ B
Capital Con.	A			A							A	-1	1														≤ B
Crop Trans.	-A	1	1																								≤ 0
Live Trans.				-A	1	1				1																	≤ 0
FFW Trans.							-A	1	1																		≤ 0
Nutrient Tr.			A			A			A																		≥ B
Year 2																											
Resource Con.														A			A			A			-1				≤ B
Capital Con.	A	-A		A	-A			-A					-A	A			A						A	-1	1		≤ B
Crop Trans.														-A	1	1											≤ 0
Live Trans.										-1							-A	1	1								≤ 0
FFW Trans.																				-A	1	1					≤ 0
Nutrient Tr.																A			A			A					≥ B
Equity				-A													-A									1	≤ 0

Definitions: CP, crop production; CS, crop selling; CC, crop consumption; LP, livestock production or purchase; LS, livestock selling; LC, livestock consumption; FR, food for work receive; FS, food for work sold; FC, food for work consumed; LT, livestock transfer; HL, hire labor; BO, borrowing; SA, savings; ET, equity transfer; RHS, right hand side; A,B, and C, non-zero or one coefficient.

basic production technology employed in the study area is simple manual hand tools. The use of fertilizers or any other chemical inputs other than own animals' manure is almost negligible. The main variable input in the farm operation is own family labor. However, a number of farm households utilize draft animals and hire-in labor depending on the size of the family labor. Traditional technology, therefore, refers to a production system that mainly depends on own seed, family labor, simple hand tools and own work animals, while the low technology refers to a production system that may include, in addition, work animals, improved seed, and hired labor in its farm operations. Hence, maize1 and maize2, for example, refer to maize produced using traditional technology and low technology, respectively. Other crop activities included in the plan are selling and column transfers to own consumption of each crop. Per acre resource requirements were developed for each crop in each production system from the survey data.

The livestock activities that are included in the plan are only for goats and cows. As discussed in Chapter II, livestock in the study area are an unimproved local-type. In Kenya, four levels of intensification (or production systems) are often identified: (a) local East African Zebu cattle and local East African goats, referred to as local breed livestock, (b) cross-breed grazing, (c) Grade semi-zero grazing, and (d) Grade zero grazing. The distinguishing factors of these production systems are the types of breeds (i.e. local or exotic)

and the type of feed used. As the production system evolves from local breed to grade zero, both the input requirements and the associated yields, in terms of milk and meat production, increases. The first production system is what is practiced in the study area. Both the cattle and goats are fed from natural pastures on non-arable community grazing land and are often taken to rivers or reservoirs for watering. In this system, input requirements, except labor, are very low. Hence, only labor is used as a constraint for livestock activity. The estimated production parameters per adult female cow and goat with their respective followers are presented in Appendix A (Table 4.5). All cows and goats are assumed to be internally retained and hence purchasing activities are not considered in the plan. Milk and meat are included as both selling and transfer activities.

The FFW activity involves maize, beans and oil. Beans and oil are entered separately into the plan as both consumption and selling activities. Maize, however, is linked to farmers' own maize production through the maize transfer row. It too can either be sold or consumed. Since FFW activity takes place throughout the year, January through December inclusive, FFW in each month is considered as an activity as well. In the tableau, the amount of food received in each month is indicated across each month's column and transfer rows of maize, beans and oil. Representative participant households are allowed to come into the plan in units of 100 hours, thereby receiving all three crops. In other words, once a participant enters the FFW activity, that individual

is assumed to remain the whole month (i.e. 100 hours). The only resource requirement for FFW activity is family labor. For each 45 kgms. of maize, 4 kgms. of beans, and 1.5 kgms. of oil, participants have to allocate 100 hours of family labor. It is important to note that the receipt of these crops is mutually inclusive. Participant households must receive all the three items in the specified ratio. This is the design of the program in the study area.

The labor hiring activities take place six months of the year. Although the main labor supply for the farm household comes from own family labor, as discussed in Chapter II (Section II.2.1), a number of farm households hire-in labor during the production season in which labor demand for own farming peaks (February, March, April, June, July, and August). These months are entered in the model as separate activities to reflect the different production activities (land preparation and ploughing, planting, weeding, and harvesting). The tableau (model) is set up such that hired labor can enter in any one of these months at any level, provided that Kshs.1.50 is paid per hired man hour.

The constraints of the model are conventional and typical of many other farm level programming models. These are land, labor, and cash-capital. There are a total of 82 constraints.

Even though land in the study area appears to be in abundance, actual cultivated land at a point in time can be a restricting resource. Land is neither homogenous nor equally suitable for the three main

crops of the area. However, due to lack of reliable data, the classification of land according to its fertility and suitability of crops could not be done. Hence, the constraining land is treated as if it is homogeneous. The estimated total arable land available for the representative farm household for the three crops is 0.75 hectares.

Despite the assumption of earlier studies (for example, Lewis, 1954; Ranis and Fei, 1961) about labor surplus that may exist in the subsistence sector of an economy, labor is the next obvious constraining factor especially during certain months of the year. For the study area, these months are February, March, April, June, July, and August.

The estimated available cash-capital for the average household is Ksh.1000. The other constraint provided in the model is the minimum subsistence requirements that conform to the subsistence farm household's first objective as discussed in section IV.3.1. The constraint is formulated in terms of required nutrients (i.e., protein, carbohydrates, and fats) and included in the plan as nutrient transfers.

Other constraints are in terms of crop transfers, livestock-product transfers, and the requirement that FFW participant households come into the program in units of not more than 100 man hours per month.

Details on data preparation for both the LP and econometric models are presented in section IV.5.

IV.4. *SPECIFICATION OF DEMAND -- THE AIDS*

The functional form for the system of commodity demand equation to be used (for both the landed and landless models) is specified econometrically to conform to the Almost Ideal Demand System (AIDS) of Deaton and Muellbauer (1980a). The form for a typical demand equation for a typical household is:

$$W_{ih} = \alpha_i + \beta_i \log (Y_h^F/P) + \Sigma\gamma_{ij} \log P_j + \theta \log K_h \qquad (4.2)$$

where

W_{ih} = Average budget share of good i of household h, which alternatively could be expressed as:

$W_{ih} = P_{ih}Q_{ih}/Y_h^F$, where Q_i = Quantity purchased of good i, and P_i = price of good i

Y_h^F = Income of household h (or total expenditure and can be expressed as $Y_h^F = \Sigma_i P_{ih}Q_{ih}$)

P is a price index, and defined by individual prices as:

$$\log P = \alpha_o + \Sigma_k \alpha_k \log P_k + 1/2\Sigma_j\Sigma_k \gamma_{jk} \log P_k \log P_j \qquad (4.3)$$

K_h = number of household members

α_i, β_i, γ_{ij}, θ, where ij = 1,...,t, are parameters to be estimated.

Given (4.2), changes in relative prices are captured through the γ_{ij} terms, while changes in real per capita income (or real expenditure) are captured through the β_i coefficients.

A demand system under the AIDS specification is consistent with known economic theory without requiring additivity of the utility function (Ray, 1980). This functional form, however, like other so-called "locally flexible" functional forms such as Indirect Translog, and Generalized Leontief models, faces some criticisms when applied to time series budget data. It is now criticized for being relatively restrictive with respect to own-price elasticities of food over time (Wohlgenaut, 1984). Wohlgenaut argues, the AIDS specification treats demand for food as becoming always more inelastic with respect to prices over time provided that real income rises.[30]

However, AIDS (as specified in 4.2) is a functional form which has a variety of characteristics that are appropriate for analyzing demand for agricultural products in Third World Countries (Ray, 1980, 1982).[31] First, unlike other common functional forms, such as linear expenditure system (LES) and quadratic expenditure system (QES) for demand analysis, the AIDS system results in flexible price and income elasticities. Its functional form can also allow a greater variety of price elasticities to be determined by either estimation or *a priori* information

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[30] Wolgenaut (1984) claims that the "Fourier" globally flexible form of Gallant (1981) is the best functional form given the interest is consistent estimation of consumption behavior over time.

[31] The criticism forwarded by Wohlgenaut (1984) is less of a concern here since our study is based on cross section data, and AIDS as argued by Muelbauer (1974) is the only flexible functional form for aggregation across households. Moreover it is not an unrealistic assumption with respect to Third World countries to assume that demand elasticities of food become more inelastic as real income rises.

than most other existing demand systems. More importantly for our purpose, however, is its greater functional flexibility with regard to income elasticities.

Second, another desirable property of AIDS is that it allows the possibility of commodities being classified as either normal or inferior. This is important because it has been argued that FFW projects may have a lower social status than other cash-paid activities. Empirically food grains obtained under FFW auspices may turn out to be inferior goods from participants' point of view. This is a testable proposition that can be handled by AIDS. That is, whether $\beta_i < 0$ or > 0 (eq. 4.2), the former indicating that the commodity in question is inferior. This is allowed only in the AIDS model.

Third, demand formulation under the AIDS system is easily amenable to improving estimates in situations where data are deficient. Since this formulation is simple and linear in form, instrumental variable estimation techniques can be used when data of questionable quality are all that are available. Fourth, its functional form is consistent with Third World household budget data (Ray, 1980, 1982) and flexible enough to explicitly take into account a number of interrelationships among the various food classes in a complete demand system (Capps and *et al.*, 1983).[32]

[32] However, unlike Ray (1980, 1982) and Capps, *et al.* (1983), Deaton and Muellbauer (1980), and Wohlgenaut (1984) found the elasticities that the AIDS generated to be inconsistent with the actual consumption behavior. More specifically, Deaton and Muellbauer found positive own-price elasticities for food on British data, while Wohlgenaut's application of AIDS to U.S. data (1948-'78) resulted in

Finally, provided that P is known and symmetry is not imposed on the matrix of γ_{ij}, the AIDS system is linear in the parameters α, β, and γ, and hence estimable with ordinary least squares. Note that the price index that generates real income as defined by (4.3) makes (4.2) a non-linear system. However, this index can simply be replaced by Stone's (1953) approximation, expenditure share-weighted price index, and hence, non-linear estimation techniques can be avoided. In linearizing (4.3), Deaton and Muellbauers' approach is strictly followed, and we specify (4.3) as (4.4):

$$\log P \simeq \log P^* = \Sigma_k W_{Kh} \log P_K \qquad (4.4)$$

Estimating the AIDS model, as specified in 4.2, will explicitly allow us to measure the simultaneous impact of FFW via total expenditure, price, and household size, on demand of various crops, and the household demand for leisure. In doing so, however, three restrictions are imposed. These restrictions are:

1. the adding up condition to total expenditures,

$$\Sigma_i \alpha_i = 1, \ \Sigma_i \beta_i = \Sigma_i \gamma_{ij} = 0 \qquad (4.5)$$

2. the homogeneity condition of degree zero in both prices and total expenditure when taken together,

$$\Sigma_j \gamma_{ij} = 0 \qquad (4.6)$$

and

3. the Slutsky Symmetry conditions

$$\gamma_{ij} = \gamma_{ji} \qquad (4.7)$$

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income and price elasticities that were inconsistent with observed behavior.

These restrictions must hold in order for the AIDS system to preserve all the properties of known demand theory.

Our AIDS specification in (4.2) parallels that of Deaton and Muellbauer (1980), Ray (1980, 1982), and Capps *et al.* (1983). However, since the purpose of this study is quite different from these studies there exists a significant difference with respect to definition and derivation of certain variables, income in particular. This is because we are interested in (1) incorporating the effect of income changes resulting from the production side of the household model into the demand segment of the model, and (2) deriving demand curves for leisure. Thus, the income term Y_h^F, in (4.2), requires some elaboration.

The income of household h, Y_h^F, is defined as:

$$Y_h^F = W x E_h x T_h + \sum_{i=1}^{n} \pi_h + M \quad [33] \qquad (4.8)$$

where

W = wage rate

E_h = number of working members of household h (i.e. members between the ages of 15 and 64 inclusive)

T_h = total time endowment of each working member in household h

π_g = net income (or profit) of household h from n activities in class g.[34]

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[33] Note, when a landless household is considered, the π term will be dropped.

[34] For the purpose of estimating π, farm households are distinguis hed

M = income from other sources

The income that is characterized by (4.8) is Becker's (1965) "full income" concept. This concept explicitly allows labor supply decision to be incorporated into demand analysis. It is from this concept that the value of leisure (i.e. wage rate times leisure time) can be used in demand formulation, thereby allowing a direct estimation of demand for leisure. Note, the income term (Y_h^F) includes both the disposable or money income (Y_h^E) and the imputed value of leisure. Hence, Y_h^E could easily be calculated by subtracting the imputed value of leisure from the full income, Y_h^F. To be sure, Y_h^F corresponds to total expenditure since it doesn't include saving. The π term in the income equation is to conform with our theoretical approach of HFM as presented in Chapter III. It is derived from the LP maximization problem as discussed in (4.1).

Now, let us put equations (4.2) and (4.8) in perspective. In Chapter III, we argued that farm households behave as households (consumers) and as firms (producers). Equation (4.2) indicates that their demands as households depend on incomes and relative prices. However, (4.8) suggests that unlike other non-farming households (such as urban and landless households), their income as firms include income generated from production activities. These incomes are neither independent from relative farm prices nor from any other shocks that

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by land size owned. Thus, households are indexed by g=1 to 9 indicating landless, land holdings $0 \leq .25$; $.26 \leq .50$; $.51 \leq .75$; $.76 \leq 1.00$; $1.01 \leq 1.25$; $1.26 \leq 1.50$; $1.51 \leq 1.75$; and $1.76 \geq 2.0$.

affect their farming activities, FFW for example. Thus (4.2) is the integrated model that accounts for the dual nature of rural farm households as presented by (4.8).

IV.4.1. *Estimation and Formulation of Elasticities*

In estimating (4.2), we strictly followed the procedure outlined by Ray (1982). Although these equations are linear in prices, they require a non-linear estimation method because of the cross-equation restrictions imposed on γ_{ij} (4.7). Thus, the estimation method was non-linear IZEF of the iterative Zellner procedure (Zellner, 1962, 1963). Following the arguments put forward by Kmenta and Gilbert (1968), Ray has shown that the IZEF procedure leads to maximum likelihood estimates for linear equations such as (4.2). Therefore, this is the procedure followed here.

In the past, expenditure (or demand) studies that consider only size of household (K_h) as in (4.2), have been criticized for not including other household compositions. In other words, the model in (4.2) ignores the "intra-family" consumption/distribution problem of commodities. Therefore, it is necessary to redefine K_h to include other relevant household characteristics.

In a study in which the unit of analysis is the household rather than the individual, a number of other household characteristics such as age and sex must be incorporated into the analysis (see, for example, Deaton and Muellbauer, 1980b). This is because different members of the household have different consumption requirements.

The empirical application of the model (4.9) when K_h represents more than household size, however, has been somewhat limited due to data limitation on the variable K_h. Deaton and Muellbauer (1980) using British data assumed, K_h to be constant across households. Ray (1982) however extended the estimation of the AIDS model by explicitly including family size using Indian budget data. Given the hetrogeneity of other demographic factors (i.e. other than size) such as household age-sex composition across households, Ray's analysis is still considered to be restrictive because (1) other household characteristics are ignored and (2) it assumes that household size has an identical impact on demand for all commodities. In this study an attempt will be made to include households' age-sex composition for each commodity estimated.[35]

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[35] In defining K_h we strictly follow the Buse-Salathe "adult equivalents" scale formulation, and specify K_h as:

$$K_h = P + \psi_i Q + \varepsilon_i R + \delta_i S + \tau_i T + \mu_i U + \nu_i V \qquad \text{(F4.1)}$$

where

K_h = the number of adult equivalents in household h.

P, Q, R, S, T, U, and V are weighted sums that reflect household size and the age-sex composition, and are computable given the age-sex composition of the household;

ψ_i, ε_i, δ_i, τ_i, μ_i, and ν_i are scale parameters to be estimated;

and i = 1, 2, ..., n food classes.

Hence, equation (F4.1) could be rewritten as

$$W_{ih} = \alpha_i + \beta_i \log(Y_h F/P) + \Sigma \gamma_{ij} \log P_j + P + \psi_i Q + \varepsilon_i R + \delta_i S + \tau_i T + \mu_i U + \nu_i V \qquad \text{(F4.2)}$$

Now, provided that the estimated value of ε, μ, ν, and ψ are not equal to 1 and $\delta = \tau = 0$, estimating (F4.2) will increase the precision of the analysis. Also, note that if $\mu = \nu$ and $\psi = 1$, sex of household members is not relevant in explaining consumption behavior of household. On the other hand, however, if ε, μ, ν, and $\psi = 1$, and $\delta = \tau = 0$, (F4.2) will simply collapse to household size and the relevant equation would simply be (4.2).

The estimation was performed on seven commodities, including leisure. The commodities were millet and sorghum (M), maize and beans (C), meat, milk, eggs and fish (D), other food items (O), FFW items (A), non-food items (N), and leisure (L). Other food items (O) includes all items, except M, C, D, and A, such as other food grains, (or minor grains) vegetables, legumes, and fruits. D includes all meat products, milk, eggs, and fish. A includes only maize, beans and oil. N on the other hand includes a number of market purchased items such as clothing, shelter maintenance, household durables, fuels, health care items, and miscellaneous household expenses.

The estimated equation for each commodity item for household h can be written as in (4.9-4.15).

$$W_M = \alpha_M + \beta_M \log(Y_h F/P) + \gamma_{MM}\log P_M + \gamma_{MC}\log P_C + \gamma_{MD}\log P_D + \gamma_{MO}\log P_O + \gamma_{MA}\log P_A + \gamma_{MN}\log P_N + \gamma_{ML}\log P_L + \theta \log K_h \quad (4.9)$$

where W_M = average budget share for millet and sorghum.

$$W_C = \alpha_C + \beta_C \log(Y_h F/P) + \gamma_{CM}\log P_M + \gamma_{CC}\log P_C + \gamma_{CD}\log P_D + \gamma_{CO}\log P_O + \gamma_{CA}\log P_A + \gamma_{CN}\log P_N + \gamma_{CL}\log P_L + \theta \log K_h \quad (4.10)$$

where W_C = average budget share for maize and beans.

$$W_D = \alpha_D + \beta_D \log(Y_h F/P) + \gamma_{DM}\log P_M + \gamma_{DC}\log P_C + \gamma_{DD}\log P_D + \gamma_{DO}\log P_O + \gamma_{DA}\log P_A + \gamma_{DN}\log P_N + \gamma_{DL}\log P_L + \theta \log K_h \quad (4.11)$$

where W_D = average budget share for meat, milk, eggs and fish.

$$W_O = \alpha_O + \beta_F \log(Y_h F/P) + \gamma_{OM}\log P_M + \gamma_{OC}\log P_C$$

$$+ \gamma_{OD}\log P_D + \gamma_{OO}\log P_O + \gamma_{OA}\log P_A + \gamma_{ON}\log P_N + \gamma_{OL}\log P_L + \theta\log K_h \quad (4.12)$$

where W_O = average budget share for other food items.

$$W_A = \alpha_A + \beta_A\log(Y_h F_{/P}) + \gamma_{AM}\log P_M + \gamma_{AC}\log P_C + \gamma_{AD}\log P_D + \gamma_{AO}\log S_O + \gamma_{AA}\log P_A + \gamma_{AN}\log P_N + \gamma_{AL}\log P_L + \theta\log K_h \quad (4.13)$$

where W_A = average budget share for FFW items.

$$W_N = \alpha_N + \beta_N\log(Y_h F_{/P}) + \gamma_{NM}\log P_M + \gamma_{NC}\log P_C + \gamma_{ND}\log P_D + \gamma_{NO}\log P_O + \gamma_{NA}\log P_A + \gamma_{NN}\log P_N + \gamma_{NL}\log P_L + \theta\log K_h \quad (4.14)$$

where W_N = average budget share for non-food items.

$$W_L = \alpha_L + \beta_L\log(Y_h F_{/P}) + \gamma_{LM}\log P_M + \gamma_{LC}\log P_C + \gamma_{LD}\log P_D + \gamma_{LO}\log P_O + \gamma_{LA}\log P_A + \gamma_{LN}\log P_N + \gamma_{LL}\log P_L + \theta\log K_h \quad (4.15)$$

where W_L = average budget share for leisure.

Only six of the seven commodity equations need to be estimated. The parameters of the seventh commodity, W_L in this case, are simply determined using the restrictions (4.5-4.7).[36] The γ_L and the β_L are calculated from the adding-up restriction, and the γ_{Li} (where i=M, C, D, O, A, and N) are determined from the homogeniety and

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[36] There is neither a unique economic nor empirical argument for dropping (4.15) from estimation. Any one of the seven equations could have been dropped. Note, however, once it is dropped it is no longer independent of the remaining equations. This procedure is valid with the assumption that the remaining six budget share equations have additive disturbances (Capps *et al.*, 1983).

symmetry conditions as follows:

From (4.5),

$$\Sigma\alpha_i = 1, \text{ hence, } \alpha_L = 1 - (\alpha_M + \alpha_C + \alpha_D + \alpha_O + \alpha_A + \alpha_N)$$

$$\varepsilon\beta_i = 0, \text{ hence, } \beta_L = -(\beta_M + \beta_C + \beta_D + \beta_O + \beta_A + \beta_N)$$

From (4.6),

$$\gamma_{LL} = -(\gamma_{LM} + \gamma_{LC} + \gamma_{LD} + \gamma_{LO} + \gamma_{LA} + \gamma_{LN})$$

From (4.7),

$$\gamma_{LM} = \gamma_{ML};\ \gamma_{LC} = \gamma_{CL};\ \gamma_{LD} = \gamma_{DL};\ \gamma_{LO} = \gamma_{OL};$$

$$\gamma_{LA} = \gamma_{AL};\ \gamma_{LN} = \gamma_{NL}.$$

Expenditure (or income) elasticity (ε_{yi}) and both uncompensated (ε_{pij}) and compensated (ε^*_{pij}) own and cross price elasticities, and household size elasticity (ε_{si}) are obtained from (4.2), and are expressed as in (4.16 - 4.19):

$$\varepsilon_{yi} = 1 + \beta_i/\bar{W}_{ih} \tag{4.16}$$

where $\bar{W}$ = mean of the budget share.

$$\varepsilon_{pij} = 1/\bar{W}_{ih}\,[\gamma_{ij} - \beta_{ij}(\alpha_j + \Sigma_k\,\gamma_{kj}\log P_k)] - \delta_{ij} \tag{4.17}$$

where $\delta_{ij} = 1$, when $i = j$

$\delta_{ij} = 0$, when $i \neq j$

$$\varepsilon^*_{pij} = E_{pij} + E_{yi}\bar{W}_{jh} \tag{4.18}$$

$$\varepsilon_{si} = \theta_i/\bar{W}_{ih} \tag{4.19}$$

IV.5. *DATA BASE: SAMPLING PROCEDURE AND RELEVANT DATA PREPARATION*

The data for this study were collected from Ewalel and Marigat locations of the Baringo District, Rift Valley Province of Kenya, during the seven months of field work by the author (August through February, 1984).[37] These locations were chosen in consultation with the faculty of economics at Egerton College, WFP at Nairobi and through in-depth discussions with the coordinators and field specialists of the Baringo Pilot Semi-Arid Area project at Marigat.[38] The collaboration of Egerton College in this research played a pivotal role as shown in Figure 4.2.

The study period covered one calendar year, February 1983 through January 1984. The reason the study period began in February and ended it in January was to have the harvesting season (June through August) as close as possible to the enumeration period so that information regarding harvests and their distribution to various uses could be easily recalled.

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[37] Dr. B. J. Deaton was on site for 3 weeks (Sept. 13 - Oct. 8) to assist in the initial pre-testing, training enumerators, etc.

[38] The Magarani Rural Development and Settlement Project in the coast province was also considered and visited with the help of WFP's personnel at Nairobi. However, It was felt that the FFW project at Ewalel and Marigat locations was the most important active program that needed examining because (1) it is being used as a pilot project to determine whether the FFW program is effective in improving the living status of participants in a food deficit semi-arid area, and (2) this program has been in existence since late 1981 and is relatively more active than other FFW programs supported by WFP. Thus, all the parties involved in the selection process of study site (as mentioned above) suggested that the FFW program at Ewalel and Marigat locations be analyzed.

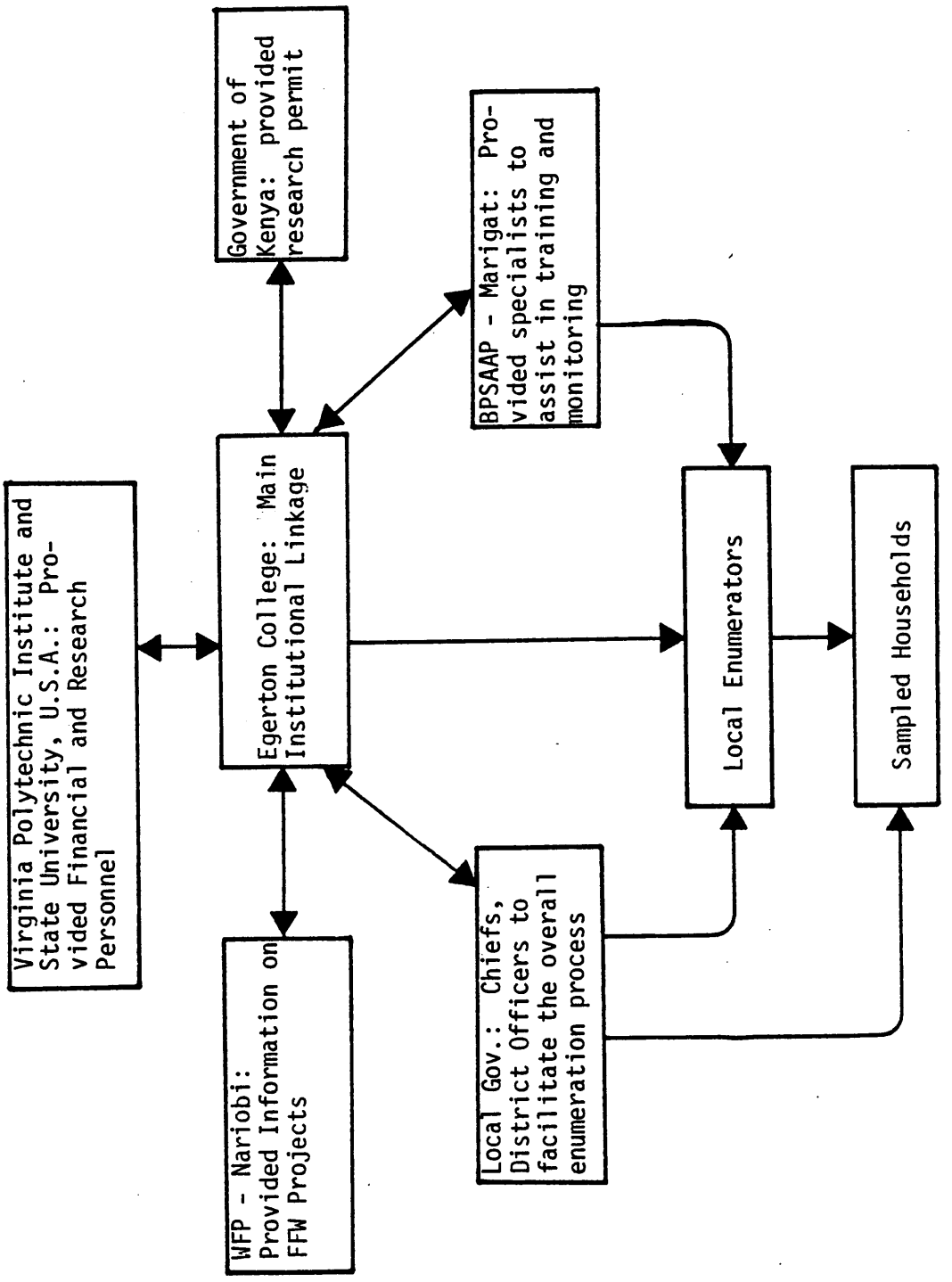

FIGURE 4.2: Schematic Representation of Steps Taken Pre-formal Survey.

In order to obtain a sample of households for this study, first a comprehensive census of households for the defined study locations was taken by using the selected local enumerators. A total of 1030 households were identified. Then, a representative sample of 300 households (30 percent) were obtained using a single random sampling procedure consistent with Krejcie and Morgan's formula (Krejcie and Morgan, 1970). Of these 300 households, 100 households (33 percent) were found to be participants of FFW projects during the study period.

Because future analyses were anticipated which would require an equal number of participant and non-participant households, an additional 50 FFW participant households were randomly selected from lists of the total of 397 participant households provided by Soil and Water Conservation Department. However, 27 of these households were found to be in both samples. Thus, the final number of households surveyed was 323 of which 123 were FFW participants.[39]

Sampled households were interviewed at least once during the course of three months (Oct.-Dec.) to obtain the necessary information concerning household's characteristics; asset ownership such as land, livestock, and other fixed capital; production and labor use. Then households were interviewed at least twice about their expenditures.[40]

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[39] The final sample households used in the estimation were 80 participants and 172 non-participants. Marigat town was excluded.

[40] Only the head of the household was interviewed. Almost 98% of the heads of households were males.

In quantifying household expenditures on food and non-food items, households were visited once each month (October through December) to determine their monthly average expenditures. Ideally, direct observation for frequently purchased items and weekly visits for the entire study period (one year) would have been preferred (Smith, Victor, E., *et al.*, 1982). However, since the area faces a single production or harvest period, which is the main source of income, variations in expenditure patterns within the year are expected to be very minimal.

In a subsistence economy, households tend to have regular buying habits and hence may not be willing to change their normal behavior within a period of one year unless there is a "sudden" change in actual or expected income. A significant variation, however, may occur during the harvest season (June through August). Thus, it was also important to ask households to recall their monthly average expenditures during the harvesting months. As one might expect, these figures were significantly different than those collected during October/December (post harvesting months). Unfortunately this did involve a recall of two to three months. Figures were averaged to reflect monthly and then yearly expenditures.

In principle, data on household expenditures should have been collected for the pre-harvest months (April and May) as well, since one might expect a shift of expenditures from non-food to food items. Such data could not be collected because of the length of recall periods.

Hence, the monthly average expenditure for the post harvesting or interview period was applied to the pre-harvesting months as well. Other variations that might not be captured by either the harvesting or the interview periods could be due to changes in household characteristics and periods of celebration of holidays, and/or fasting during the year. Since our study period is one year, changes due to these factors are assumed to be insignificant, if there is any at all, for the Tugen location (study area).

The critical period for production data is the period between land preparation and harvesting inclusively (Smith, *et al*. 1982). For the current study, this is February through August. Households were asked to provide approximate average information on inputs by crops, harvests received, disposal (or use) of harvests, and labor use by activity. Although it is a much longer recall period, households seemed to respond with a relatively high degree of certainty when it came to inputs to own production (including livestock). A partial explanation for this is that in a subsistence economy, neither the level of inputs used nor the pattern and technique of production change to any great degree from year to year. As a result, household farming activities of the current year seem to be a repeat of the previous year. Hence, farm households can recall and are able to give at least "average" usable information concerning their production activities (see for example, Ferroni, 1982). However, quantifying yield per acre (or total harvest) own consumption, and amount sold is very difficult.

Consequently, some highly questionable figures were checked by and compared with data from secondary sources. In this regard, data from the Farm Management Division of the Ministry of Agriculture and Livestock Development at Nairobi were very helpful.

The validity and soundness of the information collected by 16 trained enumerators were checked and re-checked during the enumeration period with the help of two technical field assistant specialists of the Ministry of Agriculture and Livestock Development who were stationed in the study area of Kibingor and Marigat. As a result of these efforts, some households had to be visited more than three times. As pointed out, the overall data base relies on recall information. This implies that the reliability and validity of our data depends on the capacity of all participants in the enumeration process to judge household responses and to probe accordingly. The specific steps taken in developing the questionnaire and, enumerators selection and training are discussed in Appendix B. The final questionnaire is in Appendix C.

IV.5.1. *Calculation of Quantity Data*

Annual household production was estimated by simply adding quantities harvested during each month for those households who gave more than one production figure (e.g., one for June, one for July, and one for August). However, more than 75 percent of our sample households responded with a single production figure for each crop harvested for the entire harvesting season. In this case, data obtained

from household responses were used as the final annual production figures. This may not be all that unrealistic for households which face a single-short harvesting season, but is nonetheless open to question. Fortunately, other budget data were available to which our production data could be compared. Detailed budget data (input/output relationships) for zone LM5 were constructed with the collaboration of the Farm Management Division of the Ministry of Agriculture and Livestock Development at Nairobi with data from other sources.[41] The constructed input/output coefficients were further adjusted to reflect our specific research location (see Appendix A Tables 4.1 through 4.6).

In a semi-subsistence economy, household food consumption comes mainly from two sources, food from own production and food purchased on the market. Quantities consumed from own production were calculated using the disappearance (or residual) method. Although households did recall both quantities (own consumption as well as sold), it was decided that household responses to quantity sold was relatively more reliable than the response on quantity consumed from own production. The reason is most likely that sales or purchases are usually expressed in some form of common household measures (bags, tins, cups, hands, etc.) and hence, the quantitative recall may be relatively reliable. Since information on household inventories were impossible to ascertain, total own production during the study period

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[41] Budget data constructed solely from our data were comparable yet superior with respect to yield and labor requirements for crop and livestock activities.

was taken as a starting point.[42] From this figure, quantities sold and donated were subtracted. This last figure reflects the final amount of own consumption from own production.[43]

Annual quantities of market purchased foods were constructed by simply summing the average monthly purchases for each item. In calculating the monthly average purchases, however, we applied the average of the post-harvest periods (October/December) to all months other than the harvest periods (June through August) which were averaged separately. Hence, this procedure assumes that the October/December average purchases were identical to that of other months, (i.e., except to the June/August average), in a single production period. This was the final calculation for those major purchased food items. However, after the above calculation was made, miscellaneous food purchases had to be aggregated to form "other miscellaneous food purchases." Since these items were purchased at different stages of production (e.g., grain vs. flour), it was necessary to convert all the processed food items to grain-equivalents. These figures, consumption from own production and consumption from purchase, were added by selected commodities to arrive at total consumption.

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[42] Figures on annual spoilage of crops was also impossible to obtain.

[43] Change in inventories was assumed to be zero, from the beginning to the end of the crop year, i.e., during the study period. Here, also, it is important to note that we assumed that all quantities sold were sold in unprocessed form so that direct subtraction was possible. This might be an unrealistic assumption since some households may in fact sell in processed (or flour) form.

In deriving total quantities consumed out of food received from FFW participation (wage in kind), quantities sold and donated were subtracted from the total receipts. Total receipts of each participant household were calculated by multiplying the number of days worked on FFW projects times the daily ration of 2.25 kg. of maize, 0.2 kg. of beans, and 0.075 kg. of oil. These figures were simply added to arrive at each household's total receipts of each item for the study period. These figures are highly reliable because neither the rate of receipts nor the number of working days in a month change.

IV.5.2. *Calculation of Price Data*

Average prices of each item sold and purchased were calculated for the sample households. Average prices were calculated for each household since it was evident from our survey that each household purchased at prices different from other households for similar transactions. Although our research area is thought of as a single homogeneous region, households are neither homogeneous with respect to their household composition and factor endowments, nor do they face identical market locations. There are a number of different market centers throughout the study region as well as in the surrounding area. Thus, the differences in price paid may not be due to the actual market prices that these households face at a particular period of time in a particular place but rather to the heterogeneity of market centers and timing of the transaction.[44] Because buying and selling behavior of

[44] It is important to note that the price differences among market

each household at a given time depends, in part, on demographic characteristics and ownership of assets (land, capital, livestock, etc.), different households transact at different times of the year and in different market locations. Hence, it is plausible that each household would buy items at different prices. One could argue that price differences due to differences in factors endogenous to the household, say when to purchase, do not justify the argument that each household faces different prices. However, it was felt that exogenous factors such as different marketing locations and transportation costs were the overwhelming factors in causing these price differences.

Sales prices used to evaluate own and purchase prices used for purchased consumption were averaged to obtain single prices for each food item.[45] These prices were then used to obtain the final weighted average prices for each aggregate group (e.g. maize and beans were added together). A single weighted average price was calculated for those items received from FFW.[46] For the non-food items, a weighted

centers may not be strong enough to offset transportation cost and opportunity cost of household traveling time.

[45] Ideally, farm gate selling prices should be used for consumption out of own production. However, these prices were difficult to determine. Also, in converting food receipts from FFW to cash-equivalent, applying a wage rate instead of an average market price would have been another alternative. However, the fact that these households are paid in food rather than in cash indicates that the use of existing wage rates may not be appropriate units.

[46] While prices for maize and beans receipts vary by household, price for oil receipts was assumed to be the same across household. Marigat-town price was used. This is because oil is a new item in the diet introduced by the FFW program and, hence, there was neither sales price nor purchase price information that varies by

expenditure index was constructed. Since items in this group were in different units, we assumed that the unit is one; second we assumed that the weight of the non-food items are the same across households (i.e., all households weigh non-food items the same).[47] Then, the weight for each item purchased was obtained by dividing the total expenditure of all the households on each item by the total expenditures of all non-food items of all the households. These weights were then multiplied by the actual expenditures on each item for each household, and the results were summed to obtain a single weighted index by households.[48] Descriptive statistics of variables used in estimating the AIDS model are exhibited in Table 4.3.

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household.

[47] This assumption is not too unrealistic since most of the items in this group are necessities.

[48] Note that we have, from our data, total expenditure (P_iq_i) for all non-food (or unitless) items by households. First, we summed total expenditures on all non-food items across sampled households; i.e. if the households spent on clothing (P_1q_1) and transportation (P_2q_2), we summed these expenditures, $\Sigma(P_1q_1 + P_2q_2) = X_n$, total expenditures on all non-food items of all the households. Participants and non-participants were separately calculated. Second, expenditure on clothing and transportation were separately added across households, $\Sigma P_1q_1 = x_1$ and $\Sigma P_2q_2 = x_2$. Third, $x_1/X_n < 1$, and $x_2/X_n < 1$

(note: since we assumed the unit to be 1 the q's will drop out.) The fractions from this third step were taken and used to multiply the respective expenditures for each household. Example: Expenditure of a particular household on clothing is 200 Kshs. and transportation in 100 Kshs. The weighted expenditure index, thus, is $x_1/X_n \times 200 + x_2/X_n \times 100$.

Table 4.3. Descriptive Statistics of Variables in the AIDS Model

Variable	Participants (N=80) Mean	Std Dev	Min	Max	Non-Participants (N=172) Mean	Std Dev	Min	Max
W_M	.01721	.02645	.00041	.13600	.03748	.04285	.00074	.22828
W_C	.03336	.01176	.00027	.15834	.07003	.07593	.00080	.45422
W_D	.1282	.11411	.00554	.58594	.25128	.05875	.00131	.44643
W_O	.01686	.02485	.00131	.16682	.02879	.04266	.00084	.276076
W_N	.09257	.11331	.01964	.74412	.12964	.07906	.0007	.64841
W_A	.07918	.06384	.00510	.27650	N/A	N/A	/A	N/A
W_L	.63269	.13704	.19722	.89094	.48279	.11735	.17462	.93715
P_M	1.25687	.39430	.28517	2.07944	1.37572	.40131	.11653	2.30258
P_C	.84290	.37365	.04879	2.01089	1.01925	.32626	.10000	1.85473
P_D	2.4929	.65552	.69315	4.16334	2.48892	.47905	.04887	2.69563
P_O	.94853	.41033	.10436	2.51041	.88947	.44754	.27296	3.38777
P_N	1.57095	.92660	.05912	5.45491	.65789	.84861	.70554	2.8444
P_A	.72294	.22096	.19062	1.37877	N/A	N/A	N/A	N/A
P_L	.63907	.65681	.99826	1.51542	1.50609	.92090	.35423	1.72480
K_h	1.49417	.40797	0	2.19722	1.52417	.47712	0	1.00000
Y_h^F	9.08143	.57155	6.70457	10.32048	8.84987	.55825	6.92603	10.14876

where: W_M = average budget share of millet and sorghum; W_C = average budget share of maize and beans; W_D = average budget share of meat, milk, eggs and fish; W_O = average budget share of other food items; W_N = average budget share of non-food items; W_A = average budget share of FFW items; W_L = average budget share of leisure; P_M = price of millet and sorgum; P_C = price of maize and beans; P_D = price of meat, milk, eggs and fish; P_O = price of other food items; P_N = price of non-food items; P_A = price of FFW items; P_L = price of leisure; K_h = household size; Y_h^F = household's full (or total) income.

In calculating prices received however, we averaged prices across households for each item sold. This was because the production model is based on "representative farm household" production behavior.

IV.5.3. *Labor, Income and Other Inputs*

Household labor supply was determined from our survey, and includes work on all agricultural and non-agricultural activities of the households and labor sold-out for both money wage and in-kind receipts. This measure is expressed in man-hours. Labor supply by those members under the age of 15 years, and differences in labor due to sex were ignored.[49] Leisure time, or consumption of leisure was obtained by subtracting total worked time and eight hours of sleeping time from the total time available for each working member of the household. It is a residual measured in man-hours. Total work time available to each household was calculated by simple multiplication of working hours by working family members. These figures were then adjusted for fluctuations in the number of working family members, and for sickness and holidays over the study period.

Household labor demand was the sum of household-firm demand for labor for farming activities at different stages of production (for example, land preparation, planting, weeding, harvesting) during the survey period. Wages were obtained from the survey data by dividing

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[49] For the production segment of the model, 10 hours of children's labor per year were included in the total labor since those households members between the ages of 7 and 14 contribute by herding livestock during the wet season (April through September).

total income from all sources by the total labor hours worked. This figure was then used as the price of leisure. It is measured in Kenyan Shillings per man-hour. Total household full-income (or expenditure) was calculated to conform to equation (4.8). It was calculated by simply multiplying the wage rate by the total time endowment of each working member (excluding labor hours used in farming, plus net income from farming and other sources. Total land used was obtained as a simple sum of all lands cropped (for example good land, poor land) during the study period. No quality adjustment was made.

Other capital inputs are almost negligible. Since the production techniques, as discussed earlier, are of a traditional type, very little fertilizers are used and no machinery at all.

Chapter V

RESULTS OF THE PRODUCTION AND CONSUMPTION MODELS

V.1. *INTRODUCTION*

This chapter presents the results of both the production and the integrated (or full) models. First, the results of the production side, the Linear Programming Model (LPM), are discussed. These results are based on the assumption that production behavior of the farm household is separable from the consumption behavior (see Chapter IV). Then, the results of the integrated model which incorporates the net income derived from the production side are presented.

V.2. *RESULTS OF THE PRODUCTION MODEL: THE LPM*

The results of the optimal resource allocation plan for households without and with the FFW activity are presented in Tables 5.1 and 5.2 respectively. The net returns of the representative farm households with FFW activities are 52 percent higher than those without the FFW activities. The net return at the end of the 2 year production plan is 7328 Kshs. for participants and 4810 Kshs. for non-participants.[50] Returns for non-participants are restricted by the amount of arable land available in both years. The marginal value of land per hectare is 1565 Kshs. in year 1, and 1252 Kshs. in year 2. Returns for FFW

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[50] Note that non-participant households and households without FFW activity are used exchangeably since the production result of the former was identical to that of the latter.

Table 5.1. Optimal Resource Allocation and Income Without FFW Activity

YEAR 1:

Item	Level in the Optimal plan	Amount Available	Amount Unused	Opportunity Cost
Land (Hectare)	0.75	0.75	0.75	1565.00
Labor (Mh)				
January	339.00	339.00	--	2.10
February	339.00	339.00	--	2.10
March	339.00	339.00	--	2.10
April	342.00	349.00	6.50	--
May	312.50	349.00	36.50	--
June	349.00	349.00	--	2.10
July	331.25	349.00	17.75	--
August	332.29	349.00	16.71	--
September	282.50	349.00	66.50	--
October	282.50	349.00	66.50	--
November	339.00	339.00	--	--
December	339.00	339.00	--	--
Capital	1464.50	1500.00	35.50	0.20
YEAR 2:				
Land (Hectare)	0.75	0.75	0.75	1252.40
Labor (Mh)				
January	339.00	339.00	--	18.20
February	339.00	339.00	--	1.80
March	339.00	339.00	--	1.80
April	342.00	349.00	6.50	--
May	312.50	349.00	36.50	--
June	349.00	349.00	--	1.80
July	331.25	349.00	17.75	--
August	332.29	349.00	16.71	--
September	282.50	349.00	66.50	--
October	282.50	349.00	66.50	--
November	339.00	339.00	--	--
December	339.00	339.00	--	--
Capital	1400.00	1500.00	100.00	0.20

Net Income (ending) = 4810.00 Kshs.

Table 5.2. The Effect of FFW on the Optimal Resource Allocation Plan and Income.

YEAR 1:

Item	Level in the Optimal plan	Amount Available	Amount Unused	Opportunity Cost
Land (Hectare)	0.69	0.75	0.06	--
Labor (Mh)				
January	339.00	339.00	--	2.83
February	339.00	339.00	--	2.65
March	339.00	339.00	--	2.65
April	349.00	349.00	--	2.65
May	342.50	349.00	6.50	--
June	349.00	349.00	--	2.65
July	349.00	349.00	--	2.65
August	349.00	349.00	--	2.65
September	314.00	349.00	34.14	--
October	314.00	349.00	34.14	--
November	339.00	339.00	--	2.83
December	339.00	339.00	--	0.70
Capital	1500.00	1500.00	--	0.71
YEAR 2:				
Land (Hectare)	0.75	0.75	--	1037.00
Labor (Mh)				
January	339.00	339.00	--	2.17
February	339.00	339.00	--	1.57
March	339.00	339.00	--	1.57
April	349.00	349.00	--	1.57
May	349.00	349.00	--	1.57
June	349.00	349.00	--	1.57
July	349.00	349.00	--	1.57
August	349.00	349.00	--	1.57
September	349.00	349.00	--	1.75
October	349.00	349.00	--	--
November	339.00	339.00	--	2.17
December	339.00	339.00	--	2.17
Capital	1000.00	1500.00	500	0.05

Net Income (ending) = 7328.00 Kshs.

participants are constrained by capital in the first year and by land in the second. The marginal value of land for the participant households is zero in the first year, and increases to 1036 Kshs. in the second year.

Participants and non-participants are assumed to have a beginning working capital of 1000 Kshs. They are also allowed to borrow up to 500 Kshs. to be paid, with 20 percent interest, at the end of the year (i.e. short term borrowing).[51] Participants borrowed all the 500 Kshs. allowed in year 1 and none in year 2, while non-participants borrowed 464 Kshs. in the first year and 400 Kshs. in the second. Note that the opportunity cost of capital for non-participants is unchanged from year 1 to year 2 (0.20 Kshs.) because credit is not constraining. Removal of 1 Kshs. would result in a decrease of net income by 0.20 Kshs. (the borrowing rate) in both years for non-participants; but, the opportunity cost of capital for participants fall from 0.71 Kshs. in year 1 to 0.05 Kshs. (the savings rate) in year 2. Hence, FFW increases capital so that, by year 2, it is no longer a constraining factor and savings of 891 Kshs. can occur. Furthermore, FFW may stimulate investment activities in year 2 that increase the value of borrowing in year 1.[52]

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[51] The 500 Kshs. credit limit is 15% of household's annual average income (see Chapter II), the assumption here is that households expected annual income will be at least as much as the actual and hence could borrow up to 15%. This percentage is based on the author's personal judgement (see footnote 52 for higher credit limit).

[52] An alternative model was also run by allowing the households to

Labor utilization is identical in both years for non-participants, with labor hired-in only in January, February, March, and June. The marginal value of labor for these months varies from 2.10 Kshs. (year 1) to 1.80 Kshs. (year 2). On the other hand, labor utilization of participant households in year 1 is sharply different from year 2. This is indicated by the marginal value of labor which varies from 2.65 Kshs. (February, March, April, June, July, August) and 2.83 (January and November) in year 1 to 1.57 (February - August), 2.17 (January, November) and 1.75 (September) in year 2. May, September and October in year 1, and October in year 2 are not limiting factors.

This large difference in marginal value of labor, especially during the production season (February through August), from year 1 to year 2 is due to the hiring activities. Both non-participant and participant households are allowed to hire-in labor only in February through August. Participant households hired-in a total of 300 labor hours, at the given wage rate of 1.50 Kshs., compared to 140 hours of non-participant households in the first year. As capital, the

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borrow up to 1000 Kshs.. The results of the non-participant households remain the same since capital is not constraining. The results of the participant households are also basically the same. The only relevant differences are as follows: opportunity cost of capital when credit limit is 1000 Kshs. = 0.24 Kshs. instead of 0.71 Kshs.; net income = 7447 Kshs. instead of 7328 Kshs.; saving = 833 Kshs. instead of 891 Kshs.; FFW participation decreased in year 2 by 2% instead of 11%; marginal value of land increased from zero to 749 Kshs. in year 1. Although there are no significant differences between these results, except the opportunity cost of capital in year 1, it is felt that the 500 Kshs. credit limit more realistically reflects the limited financial transactions of the area as compared to 1000 Kshs.

constraining factor of participant households in the first year (shadow price = 0.71 Kshs.), is relaxed in the second year (shadow price = 0.05 Kshs.), the hiring-in activity (or employment) expands by 93 percent from year 1 to year 2. In other words, participant households hired-in a total of 578 labor hours in the second year, while this activity for non-participants in the second year remained at 140 hours. As a result, the marginal value of labor for the participant households decreased from 2.65 Kshs. (year 1) to 1.57 Kshs. (year 2) in the cropping season. The ending expenditure of participants on employment (i.e. in hiring-in labor) would be 1317 Kshs., and non-participants would spend only 420 Kshs.

While participants expand employment from year 1 to year 2, at the same time, participation in FFW activity is decreases by 11%. They spend 1143 hours on FFW activities in year 1 and 1020 hours in year 2. This reflects an increase in the marginal value of their own time in farming-production activities (returns from farming activity are 2.65 Kshs. as compared to 1.10 Kshs. from FFW) as the capital constraint is relaxed. Labor use in own-farm production is 3928 hours in both year 1 and year 2 for non-participants and 4063 hours in year 1 and 4138 hours in year 2 for FFW participants. Own-farm labor is both higher for participants as compared to non-participants and increases from year 1 to year 2 (2% increase in utilization of family labor).

Given the allocation plan in Tables 5.1 and 5.2, the activities that are undertaken by the representative farm households are presented in

Tables 5.3 and 5.4. The activities in the optimal production plan for both non-participants and participant households are maize, millet, milk, and goats. Non-participants produced 560 Kgms. of maize, 40 Kgms. of millet, and 1412 litres of milk from 28 goats in both year 1 and year 2 (Table 5.3). Participant households, on the other hand, produced 24 kgms. of maize, 528 kgms. of millet, and 1074 litres of milk from 21 goats in the first year. In the second year, maize is increased by 133%(56 kgms.), millet by 3% (544 Kgms.), milk by 16%(1245 litre), and goats by 19%(25 goats) (Table 5.4). At the same time, as discussed earlier, total FFW receipts decreased from 575 Kgms. in year 1 to 512 Kgms. in year 2 (i.e. 11% decline).

Since farm households are forced, in the model, to meet minimum nutrient requirements before selling for cash income, non-participants consumed all the maize and milk produced in both years. The source of their cash income is the sale of 42 Kgms. of millet and 28 goats for a total of 4219.40 Kshs. in each year. Participants also consume all the maize produced, including that received from FFW, oil and milk to satisfy the basic nutrient requirements in the first year. The sale of millet, goat, and beans received from FFW are the source of cash-income. Total cash-income in year 1 is 5245.10 Kshs.. In the second year, the cash-income increases to 6026.55 Kshs. (i.e. 15% increase) for reasons discussed earlier. As a result, at the end of the second year participants would save 891.50 Kshs. while non-participants could not save.

Table 5.3. Optimum Enterprise Mix and Saving Without FFW Activity

YEAR 1

Enterprise	Hectares Used	Own Production	Total Consumption	Marketable Surplus	Total Income (Kshs.)
Maize[a]	.7	560	560	0	
Millet[a]	.05	42	0	42	155.40
Milk[b]	N/A	1412	1412	0	
Goat	N/A	28	0	28	4064.00
YEAR 2					
Maize[a]	.7	560	560	0	
Millet[a]	.05	42	0	42	155.40
Milk[b]	N/A	1412	1412	0	0
Goat	N/A	28	0	28	4064.00

Saving
Initial = 0
Ending = 0

[a]Measured in Kilogram
[b]Measured in Litre

Table 5.4. The Effect of FFW on Optimum Enterprise Mix and Saving

YEAR 1

Enterprise	Hectares Used	Own Production	FFW Production	Total Consumption	Marketable Surplus	Total Income (Kshs.)
Maize[a]	.03	24	512	536	0	
Millet[a]	.66	528	N/A	0	528	1953.60
Beans[a]	N/A	0	46	0	46	195.50
Oil[a]	N/A	0	17	0	17	
Milk[b]	N/A	1074	N/A	1074	0	
Goat	N/A	21	N/A	0	21	3096.00
YEAR 2						
Maize[a]	.07	56	456	512	0	
Millet[a]	.68	544	N/A	0	544	2013.00
Beans[a]	N/A	0	41	0	41	174.25
Oil[a]	N/A	0	15	15	0	
Milk[b]	N/A	1245	N/A	1134	111	255.30
Goat	N/A	25	N/A	0	25	3584.00

Saving
Initial = 0
Ending = 891.50 Kshs.

[a]Measured in Kilogram
[b]Measured in Litre

How sensitive is the optimal set of enterprises to changes in FFW participation? In order to address this question, range analysis for labor limiting months is presented in Table 5.5. As mentioned earlier, participant households are allowed to participate not more than 100 hrs. per month. However, the result of the range analysis indicates that participants could participate up to 156 hours in February, March, April, June, July and August, 140 hours in September and October, and 107 hours in May without upsetting (or changing) the current optimal activity mix of the first year. As a result, income would increase by 1.85 Kshs. per hour except in May, September and October in which income would increase by 2.83 Kshs.. The second year results show a relatively wide range except for September and October when the optimal activity would not be affected. For one additional hour participation beyond 100 hours, income would increase by only 0.60 Kshs., in February through July, and by 0.42 Kshs. in August, up to the upper limit of 309 hours, except in September and October in which income increases by 0.42 Kshs. and 2.16 up to 130 and 100 hours respectively.

If participation is increased beyond the upper limit, income would decline since marketable surplus from both crop and livestock enterprises would decline by more than the gain from participation. On the other hand, a reduction of participation below the lower limit would not necessarily lead to an income increase since capital is already exhausted (first year), and land is quite restrictive (second year).

Table 5.5. Sensitivity of the Optimum Enterprise Mix to Changes in FFW Participation

Participative Month	Level in Optimal Plan (Mh)	Range Within Which Optimal Plan not affected (Mh)		Income Effect per man hour Change (Ksh.)	
		Year 1	Year 2	Year 1	Year 2
February	100	55.72-156.00	0-309.00	1.85	0.60
March	100	55.12-156.00	0-309.00	1.85	0.60
April	100	75.36-156.00	40.00-309.00	1.85	0.60
May	100	0-107.30	70.00-309.00	2.83	0.60
June	100	55.12-156.00	0-309.00	1.85	0.60
July	100	87.41-156.00	51.25-309.00	1.85	0.60
August	100	72.31-156.00	38.00-309.00	1.85	0.42
September	100	41.10-140.00	100.00-130.00	2.83	0.42
October	100	41.10-140.00	0-100.00	2.83	2.16

When the range results of year 1 are compared with year 2, it suggests that the optimal enterprise mix of year 2 is less sensitive to changes in FFW participation than year 1 (except in September and October).

V.2.1. *Summary of the Production Results*

The results indicate that the FFW in Ewalel-Marigat location augments own farm output by contributing to the nutrient requirements of the family, and second by easing the major constraint of the area, cash-capital. This in turn led to a 52 percent increase in income; of which 23 percent was from direct employment in FFW projects (i.e. by being paid in food) and 29 percent was from its induced effects through labor reallocation and cash-capital formation. Let us now explore this result in more detail.

As outlined earlier, the modeled households are allowed to maximize net income only after meeting own subsistence consumption requirements. Given this restriction households without FFW receipts have only 24 Kgms. of millet for marketing in year 1 as well as in year 2. Households with FFW receipts on the other hand have 528 Kgms. of millet as a surplus in year 1. This is because oil received from the program is used to fulfill the fat requirement, one of the most lacking nutrients in the area; while maize received helps meet other nutrient requirements, carbohydrates in particular.[53] In year 2, the increased

[53] The oil and maize received freed up at least 528 Kgms. of millet, and 338 litres of milk in year 1, and 554 Kgms. of millet and 278 litres of milk in year 2 for sale. By the second year, milk

net income from the marketed surplus (i.e. 531 Kgms.-24 Kgms.) of year 1 increased the availability of cash-capital in year 2. This resulted in an increase in the total land under cultivation. Both maize and millet production increased. Livestock production also expands, and participants have excess milk to sell. In expanding these activities, participant households hire-in relatively more labor-hours in the second year than in the first.

The inevitable result is that as own production increases (for example the increase of maize production by 133%) food needed to meet subsistence consumption requirements from FFW start to decline. Would this decline continue, and even eliminate the desire for participation had the model included more than 2 years production plans? One might expect that for the decline to continue beyond the 2 years other highly restrictive resources such as land must be relaxed.

In summary, the injection of FFW programs in food deficit semi-arid areas, such as the Ewalel-Marigat location, where labor is not a serious binding resource, results in increased own farm production, and, hence, income (including saving), through first providing basic needs and second creating cash-capital. The impact of this newly created cash-capital on farming activities and income is significantly higher in the second year than in the first year since it has a compounding effect on employment and farm output. Thus, displacement of (or disincentive to) own farm output was not found in

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consumption increased from 1074 litres to 1134 litres.

this study. The FFW program encourages participants to shift from less profitable to more profitable farming activities, for example from maize to millet production in this case, since basic consumption requirements are now met. From this, one could assert that the FFW program may cause participants to be more price sensitive.

Next, the results of the integrated model are presented that examines how these changes (i.e. results from the production side) affect consumption decisions (or the consumption bundle) and hence nutritional status of participant households.

V.3. *RESULTS OF THE INTEGRATED MODEL: THE HOUSEHOLD-FIRM MODEL*

The full AIDS model as described in F4.2 was estimated first. However, the estimated scale parameters (eq. F4.1) were not significantly different from zero, suggesting that the AIDS collapses to a household size specification, as discussed in footnote 35 (Chapter IV). Thus, the final estimated AIDS model was (eq. 4.2):

$$W_{ih} = \alpha_i + \beta_i \log (Y_h F/P) + \Sigma_{ij} \log P_j + \theta \log K_h$$

Where K_h is simply household size.

Tables 5.6 and 5.7 present the parameter estimates and the associated standard errors of participant and non-participant households respectively. In assessing how the AIDS specification fits the sample data, following Theil and Mnookin (1966), information inaccuracy (II) measure is calculated. The II for the hth household is given by:

$$II_h = \Sigma_{ih} W_{ih} \log (W_{ih}/\bar{W}_{ih})$$

Table 5.6. Parameter Estimates for Participant Households (standard errors in parentheses).**

Commodities / Parameters	W_M 1	W_C 2	W_O 3	W_D 4	W_N 5	W_A 6	W_L 7
α_i	-.08981*	-.09505*	-.01057	.46249*	.94233*	.33 782*	-.54721*
	(.04349)	(.00461)	(.05676)	(.16267)	(.06667)	(.09659)	(.11232)
β_i	.00916*	.01948*	.01101*	-.05394*	-.10513*	-.03 819*	.15761*
	(.00461)	(.00517)	(.00646)	(.01744)	(.00712)	(.01046)	(.01230)
γ_i	.02880*	-.01618*	.00156	-.02646*	.00413	.00 658*	.00157
	(.00575)	(.00413)	(.00507)	(.00921)	(.00271)	(.00241)	(.00241)
γ_{i2}	-.01618*	-.02507*	-.03030*	.03725*	-.01459*	.04 524*	.00365
	(.00413)	(.00584)	(.00579)	(.01102)	(.00309)	(.00591)	(.00279)
γ_{i3}	.00266	.00473	.00403	-.01125	.00265	-.00 068	-.00214
	(.00555)	(.00652)	(.01303)	(.02145)	(.00965)	(.01292)	(.01645)
γ_{i4}	.00413	.00413	-.01459*	-.01970*	.02039*	.00 130	.02816*
	(.00270)	(.00309)	(.00416)	(.00744)	(.00431)	(.00226)	(.00222)
γ_{i5}	.00658*	.02816*	.00704	.01227*	.02816*	-.07 219*	-.01002*
	(.00240)	(.00226)	(.00748)	(.00797)	(.00226)	(.00573)	(.00452)
γ_{i6}	-.02646*	.02039*	.12775	-.01573	.02039*	.01 227*	-.13861*
	(.00921)	(.00744)	(.10321)	(.02903)	(.00744)	(.00797)	(.00757)
γ_{i7}	.00157	.00365	.01057	-.01386	-.01969*	-.01 002*	.01918*
	(.00241)	(.00279)	(.04342)	(.00754)	(.00222)	(.00452)	(.00269)
θ_i	-.00111	-.02119*	-.00315*	.06689*	.02307*	.04 693*	-.11144*
	(.00568)	(.00658)	(.00130)	(.02184)	(.00969)	(.01352)	(.01680)

II = .02012

* indicate statistical significance (parameter estimates are at least two times the associated standard errors).

Definitions: W_M = Average Share of Millet and Sorghum; W_C = Average Share of Maize and Beans; W_O = Average Share of Other Food; W_D = Average Share of Meat, Milk, Eggs and Fish; W_N = Average Share of Non-food; W_A = Average Share of FFW items; W_L = Average Share of Leisure.

** t-values could be calculated by dividing each coefficient by the respective standard errors.

Table 5.7. Parameter Estimates for Non-participant Households (standard errors in parentheses).

Commodities / Parameters	W_M 1	W_C 2	W_O 3	W_D 4	W_N 5	W_L 6
α_i	.05865* (.03757)	.04067* (.06562)	.23472* (.04167)	1.44484* (.13039)	.39617* (.05990)	-1.17505* (.07433)
β_i	.00156* (.00408)	.01449* (.00715)	-.01661 (.04503)	-.17606* (.01506)	-.03249* (.00671)	.20911* (.00858)
γ_{i1}	.01753* (.00406)	-.02774* (.00453)	.00430 (.00348)	-.00151 (.00308)	.00312 (.00269)	.00431* (.00218)
γ_{i2}	-.02774* (.00453)	-.01361* (.00826)	-.03626* (.00493)	.07585* (.00653)	-.00185 (.00420)	.00361 (.00396)
γ_{i3}	-.01745* (.00583)	-.02868* (.01040)	-.00610 (.05436)	-.01836 (.02256)	.01282 (.00983)	.05777* (.01281)
γ_{i4}	.00312 (.00269)	-.00185 (.00420)	-.00705* (.00310)	.03599* (.00396)	-.02316* (.00396)	-.00705* (.00213)
γ_{i5}	-.00151 (.00308)	.03599* (.00396)	-.02516* (.00365)	.01969* (.01219)	.03600* (.00396)	-.06501* (.00493)
γ_{i6}	.00431* (.00218)	.00361 (.00396)	.03206 (.02910)	-.06501* (.00493)	-.00704* (.00213)	.03207* (.00227)
θ_i	-.01072* (.00595)	-.02112* (.01032)	.03836* (.00162)	.02786 (.02281)	.01313 (.00970)	-.04753* (.01262)

II = .01827

* indicate statistical significance (parameter estimates are at least two times the associated standard errors).

Definitions: W_M = Average Share of Millet and Sorghum; W_C = Average Share of Maize and Beans; W_O = Average Share of Other Food; W_D = Average Share of Meat, Milk, Eggs and Fish; W_N = Average Share of Non-food; W_L = Average Share of Leisure.

where W_{ih} = observed average budget share of the i^{th} commodity, and

$\bar{W}_{ih}$ = predicted average budget share.

A II measure that is close to zero (provided II ≥ 0) indicates a good fit. The average II measures for participants and non-participants are 0.02012 and 0.01827 respectively, suggesting the AIDS fits both sample data exceptionally well.

With the exception of other food (W_O) the direction of responses of the budget share to the expenditure variable (i.e. β_i) is the same in both models (Tables 5.6 and 5.7). The results indicate a high degree of budget share sensitivity to real total expenditures (except W_M and W_O in the non-participants model), with significance tests having t-values greater than 2. However, as shown by the magnitude of the respective coefficients, the budget shares of all commodities except W_D and W_L are more responsive in the participants model (Table 5.6) than in the non-participants (Table 5.7). For example, the t-values in the participants model ranged from 2.0 for W_M, to 3.9 for W_C, 3.1 for W_D, 1.7 for W_O, 14.8 for W_N, and to 12.8 for W_L; while these values are 0.4 for W_M, 2.0 for W_C, 11.7 for W_D, 0.37 for W_O, 4.8 for W_N, and 24.4 for W_L in the non-participants model. Hence, except for W_D and W_L, a unit change in income would change the budget share of the participant households by at least twice that of the non-participants. On the other hand W_D and W_L of non-participants are more sensitive to income

changes than those of participants. For example, for participants, a one percent increase in real income would result in a 0.00916 percent increase in W_M (0.00156 for non-participants), a 0.01948 percent increase in W_C (0.01449 for non-participants), a 0.05394 percent decrease in W_D (0.17606 for non-participants), a 0.01101 percent increase in W_O (-0.01661 for non-participants), a 0.10513 percent decrease in W_N (0.03249 for non-participants), a 0.15761 percent increase in W_L (0.20911 for non-participants), and a 0.03819 percent decrease in W_A.

As indicated by the expenditure coefficients, meat, milk, eggs and fish (i.e. W_D) and non-food items (i.e. W_N) are characterized as necessity items in both models ($\beta_i < 0$). In addition, food aid (i.e. W_A) in the participants model and other food (i.e. W_O) in the non-participants model are classified as necessities (Tables 5.6 and 5.7).

The shares (W_i's) in both models are highly (and equally) price responsive. For the participants, 34 out of 49 price coefficients (γ_{ij}'s) and, for the non-participants, 23 out of 36 γ_{ij}'s have t-values greater than two. Out of the total 85 γ_{ij}'s, there are only 16 γ_{ij}'s (10 in the participants model and six in the non-participants model) with t-values less than a one (Tables 5.6 and 5.7). The coefficients of own-price are positive, except W_C and W_D (participants) and, W_C and W_O (non-participants). The statistical significance of including family size for each commodity is given by θ.

The results indicate a high degree of size sensitivity of budget shares with six out of seven (participants), and four out of six (non-participants) size coefficients (θ_i's) having t-values greater than two.

The uncompensated (gross) own-price and cross-price elasticities (ε_{ij}'s), real expenditure elasticities (ε_{yi}'s), household size elasticities (ε_{si}'s), and compensated (net) own-price and cross price elasticities (ε_{ij}^*'s) are presented in Tables 5.8 and 5.9 respectively. These elasticities are calculated using the mean of the sample data (Table 4.3).

The own price elasticities, with the exception of Millet and Sorghum (MS) for participants, have the expected signs. All commodities are price inelastic except MB (in both groups) and OF (non-participants). As indicated (Tables 5.8 and 5.9), the uncompensated and compensated cross-price elasticities revealed diverse patterns both in terms of direction and magnitude.

The interpretation of the elasticities for FA require some elaboration. From demand theory, the amount of FA received should be thought of as own production since it is not "directly" purchased. Thus, for example, increasing the price of FA would induce participants to increase sale thereby reducing own consumption of FA (ε_{FAFA} = -0.84), consumption of OF (ε_{FAOF} = -0.01), consumption of NF (ε_{FANF} = -0.91), consumption of L (ε_{FAL} = -0.22), but increasing the con- sumption of MS (ε_{FAMS} = 0.08), MB (ε_{FAMB} = 0.57) and MD (ε_{FAMD} = 0.35).

Table 5.8. Uncompensated Own-Price and Cross-Price Elasticities, Expenditure Elasticites and Household Size Elasticities for participants (1) and non-participants (0).

Items	MS	MB	MD	OF	FA	NF	L	E	HS
MS(1)	.6731	-.9401	.2399	.1545	-1.5374	.3823	.0912	1.5322	-.0645
(0)	-.5321	-.7403	.0832	-.4657		-.0403	.1150	1.0416	-.2860
MB(1)	-.4850	-1.7515	-.4373	.1417	.6112	.8441	.1094	1.5839	-.6350
(0)	-.3961	-1.1943	-.0264	-.4095		.5139	.0515	1.2069	-.3015
MD(1)	-.2065	.2907	-.8408	-.0878	-.1227	.0957	-.1081	.5789	.5220
(0)	-.0060	.3018	-.8537	-.0730		.0783	-.2587	.2993	.1108
OF(1)	.0446	-1.7971	-1.1684	-.7609	.5771	.4175	1.1014	1.6530	-.1868
(0)	.1493	-1.2594	-.2448	-1.2118		-.0873	1.1135	.4230	1.3324
FA(1)	.0831	.5713	.3556	-.0085	-.8450	-.9117	-.1265	.5176	.5927
NF(1)	.0831	-.1576	.0140	.0286	.2202	-.6958	-.2127	.1356	.2492
(0)	.0240	-.0142	-.1786	.0988		-.7223	-.0543	.7493	.1012
L (1)	.0024	.0057	-.0311	-.0033	-.2190	-.0158	-.9696	1.2491	-.1761
(0)	.0089	.0074	-.0146	.1196		-.1346	-.9335	1.4331	.0984

Definitions: MS = Millet and Sorghum; MB = Maize and Beans; MD = Meat, Milk, Eggs and Fish; OF = Other Food; FA = FFW Items; NF = Non-food; L = Leisure; E = Expenditure; HS = Household Size.

Table 5.9. Compensated Own-Price and Cross-Price Elasticities for participants (1) and non-participants (0).

Items		MS	MB	MD	OF	FA	NF	L
MS	(1)	.69981	-.91378	.26635	.18093	-1.51111	.40853	.11760
	(0)	-.49313	-.70129	.12223	-.42667		-.00127	.15405
MB	(1)	-.43217	-1.66216	-.38450	.19463	.66405	.89696	.16225
	(0)	-.31159	-1.10982	.05810	-.32502		.59844	.13607
MD	(1)	-.13236	.36491	-.76668	.01364	-.04860	.16994	-.03401
	(0)	.06921	.37707	-.75161	.00216		.15358	-.18349
OF	(1)	.07248	-1.76928	-1.14058	-.73310	.60497	.44543	1.12929
	(0)	.16154	-1.24728	-.23270	-1.19970		-.07521	1.12576
FA	(1)	.12409	.61235	.39663	.03240	-.80405	-.87073	-.08556
NF	(1)	.07054	-.17017	.00148	.01607	.20770	-.70835	-.22526
	(0)	.12122	.08284	-.08150	.19604		-.62516	.04285
L	(1)	.79278	.79607	.75918	.78692	.57122	.77446	-.17938
	(0)	.70083	.69938	.67730	.81156		.55725	-.24167

Definitions: MS = Millet and Sorghum; MB = Maize and Beans; MD = Meat, Milk, Eggs, and Fish; OF = Other Food; FA = FFW Items; NF = Non-food; L = Leisure.

The expenditure elasticities reveal that five out of seven commodities (participants) and three out of six commodities (non-participants) have elasticities greater than one. No commodities are characterized as inferior except non-food items (NF) for participants (Table 5.8).

Although these elasticities (ε_{yi}'s) for participants and non-participants have the same signs (except NF), the magnitude of the response of all budget shares, with the exception of non-food (NF) and leisure (L), for participants is unequivocally more than the non-participants. To illustrate, a one percent increase in real income would result in at least a 1.5 percent increase in the budget share of MS for participants but in only a 1.0 increase for non-participants, in a 1.6 increase in the budget share of MB for participants but in only a 1.2% increase for non-participants, in a 0.6 increase in the budget share of MD for participants but in only a 0.3 increase for non-participants, in a 1.7 increase in the budget share of OF for participants but in only a 0.4 increase for non-participants, in a 1.2 increase in demand for leisure for participants but in a 1.4 increase for non-participants. However, a one percent increase in real income would decrease the budget share of NF by at least 0.1 percent for participants but would increase it by at least 0.7 for non-participants. With few exceptions, budget shares are generally more sensitive to changes in real income than to changes in prices.

The size elasticities (ε_{si}'s) have positive effects on household consumption of normal and necessity items (Table 5.8).[54] However, a negative influence is predicted on those commodities that have income elasticity greater than one (luxuries). This suggests that as household size increases, *ceteris paribus*, demand for luxury commodities decline. This also confirms the fact that changes in family size are more likely to be due to children than other age groups and, hence, consumption of basic necessity items are increased (Ray, 1982). The magnitude of the size elasticities for participants is higher than the non-participants (except for OF).

The elasticities examined so far are the uncompensated type which include both price and income effects of price changes. It is useful, as well, to examine the compensated type (ε_{ij}^*) which eliminates the income effects from price changes, or simply when households are kept on the same indifference curve even after price changes, so that commodities could be classified as substitutes, complements, and independents (Table 5.9). From this table one could observe that there are a number of substitutes (positive compensated cross-price elasticities), and complements (negative cross-price elasticities). Food received under FFW (FA), for example, is a complement to millet and sorghum consumption ($\varepsilon^*_{MSFA} = -1.51$), and to meat, milk, eggs and fish ($\varepsilon_{MDFA} = -0.05$), but substitutes for maize and beans

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[54] This result is consistent with Ray's finding on Indian data, even though his inclusion of size effects into the AIDS model were constrained to be identical across commodities (Ray, 1982).

consumption ($\varepsilon^*_{MBFA} = 0.66$), other food items ($\varepsilon_{OFFA} = 0.60$), non-food items ($\varepsilon^*_{NFFA} = 0.21$), and leisure ($\varepsilon^*_{LFA} = 0.57$). Hence, a one percent change in the price of FA, after compensation, would change the consumption (demand) of these commodities as indicated by these cross elasticities (above). As expected, FA is a substitute for leisure ($\varepsilon^*_{LFA} = 0.57$) since the income effect is quite dominant. The total effect of a price increase in FA would cause a reduction of leisure ($\varepsilon_{LFA} = -0.22$). Thus, raising the price of FA may result in an incentive for work, and vise versa, via its income effect.

V.3.1. *Comparison of selected elasticities of participants and non-participants: A Summary*

The elasticities (Table 5.8 and 5.9) are computed from the integrated (or household-firm) model which treats net income (or profit) from the production side as variable and hence endogenous. Thus, the elasticities presented in Table 5.8 are the total price elasticities which include the profit effects. The elasticities in Table 5.9, on the other hand, are net of the "classical" income effect but include the profit (or net income from production) effects. Since one of the main objectives of this study is to assess the significance of being participants in FFW, rather than testing the significance of the integrated model, no attempt is made to separate out the profit elasticities from the price elasticities under a constant (or exogenous) profit assumption. The interest here is in comparing the participant with the non-participant households using selected elasticities.

To begin with, consider the compensated elasticities (Table 5.9). As suggested by traditional consumer theory, the own price effects of all commodities except for millet and sorghum (MS) for participants is negative. This suggests that, with the exception of MS for participants, the negative price effects swamp the positive profit effects, establishing the negativity of the slope of the demand function (or negative own substitution effects). In general, while the cross price effects are diverse, both in terms of signs and magnitudes, there exist no significant traceable difference between the participants and non-participants.

One significant difference between the participant and non-participant households is with respect to the consumption of millet and sorghum. For example, a price increase in millet and sorghum would result in a negative demand effect for non-participants ($\varepsilon^*_{MSMS} = -0.5$) but would increase own consumption of millet and sorghum for participant households ($\varepsilon^*_{MSMS} = 0.7$). The latter result is because an increased price also means increased profits (or income) for farm households. Thus, a significantly higher profit effect (and the income effect, see Table 5.8) is predicted for the participant households as compared to the non-participants. In this case, the classical negative demand sign is reversed by the profit effect. This result is attributable to FFW activity and is consistent with the results of the production estimates.

From the production estimates, it was found that participant households became relatively more price responsive, and as a result, shifted from producing less profitable crops to more profitable crops (i.e. from maize to millet).[55] This finding also establishes the fact that participant households do consume millet and sorghum since the profit (or income) effect overwhelms the price effect. Thus, while increasing millet and sorghum prices may have a negative impact on the nutritional status of non-participants (or any other non-millet and sorghum farming families), it has a positive impact on participant households. This removes the fear created in our production results that FFW may give incentives to the participants to increase marketed surplus which may, in turn, put the farm households at a greater nutritional risk.

The other relevant elasticities in comparing these two sets of households are the income (or expenditure) elasticities (Table 5.8). As discussed earlier, with the exception of non-food and leisure, the magnitude of the income elasticities for participants are larger than the non-participants. These differences in magnitude have an important nutritional and, hence, policy implication. All the commodities (except leisure and non-food items) are equally important in local diets and as sources of nutrition. There is a large difference between the income elasticities of non-food items for participants (ε_{yNF} = -0.13) and non-participants (ε_{yNF} = 0.75). This commodity is found to be a necessity item for both households (β_{NF} < 0). For participants this

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[55] Note: 87% of the total consumption of millet and sorghum (MS) is millet).

commodity is now inferior and, hence, a larger proportion of income changes are spent on food items. By contrast, for non-participants it is considered as a normal good and, hence, a relatively higher proportion of income goes to the purchase of this item. In fact, its income share is much higher than some of the nutritionally important items such as meat, milk, eggs and fish, and other food (ε_{yMD} = 0.30, ε_{yON} = 0.42). These elasticities for participants are relatively high (ε_{yMD} = 0.58, ε_{yOF} = 1.65).

In general, participants are more likely to spend a relatively higher part of their increased income on consumption of maize and beans (ε_{yMB} = 1.58), and millet and sorghum (ε_{yMB} = 1.53), the most important food items of the area, than the non-participant households (ε_{yMB} = 1.20, ε_{yMS} = 1.04). This may be a reflection of the fact that participants now have relatively higher incomes due to their participation (see Tables 5.1 and 5.2) and, therefore, they become not only diverse in their consumption bundle (e.g. ε_{yOF} = 1.65 as compared to ε_{yOF} = 0.42 of participants) but also sensitive to their nutritional status. For both participants and non-participants the Engel curve for these commodities does not become concave (from the origin) at the high end of the income distribution as commonly found for food stuffs.

On the other hand, non-participants are somewhat more willing to take part of their increased income in the form of leisure (ε_{yL} = 1.4) than participants (ε_{yL} = 1.2). This perhaps reflects the fact that

non-participants have relatively limited income generating activities. As a result, one would expect the opportunity cost of leisure for non-participants to be lower than for participants. This point is also reflected by the size elasticities. For example, as expected, a one percent increase in family size would cause a 0.2 percent reduction in consumption of leisure for participants. In contrast, consumption of leisure would increase by 0.1 percent for non-participants. These results indicate, without any ambiguity, that participants' labor supply is at least as great as non-participants (or as if they had not participated). This, therefore, rejects the implicit concern that income generated from FFW participation (see the income differentials between participants and non-participants in Tables 5.1 and 5.2) may result in work disincentives (or incentives for leisure) since subsistence farm households have fixed demand for cash-income (for more discussion of this point, see section II.2.1).

The results presented here indicate that there are significant differences between participant and non-participant households, especially with respect to income elasticities and price elasticities of demand for millet and sorghum. These differences, *ceteris paribus*, can be attributable, at least in part, to participation in FFW activities.

Chapter VI

CONCLUSIONS, POLICY AND RESEARCH IMPLICATIONS

VI.1. *INTRODUCTION*

This study has analyzed the relationship between FFW and, production and consumption activities in participant farm households. The analysis is conducted in two steps. First, the impact of FFW on production is examined, and second, consumption activities of FFW participant households are investigated by integrating the results of the production side. For comparison, production and consumption activities of participant and non-FFW participant farm households are analyzed using identical procedures.[56]

The main objectives of the study have been to address the following two questions:

1. Does FFW augment or displace own food supply (production), and how does it affect farm income? and,

2. What are the effects of FFW on income and hence consumption of food and non-food items? While the former concern was addressed solely by the production segment of the household-firm model, the latter was answered by both the production and consumption segments.

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[56] The non-participant households are used in order to assess the likely conditions that would have prevailed in the absence of the FFW programs.

The following sections present the conclusions of this study, and discuss the policy and future research implications.

VI.2. *CONCLUSION*

From the production side, the major conclusion reached in this study is that the effect of FFW in the Ewalel-Marigat area is to increase the availability of capital (income), which in turn leads to increasing total farm output, both own and hired labor use in farm production and net savings. The process is as follows: FFW increases marketable surpluses in the first year at the same time contributing to the nutrient requirements of the family, eases the capital constraint by the second year of participation, increases the amount of land cultivated, increases both hired and family labor in farm production and, thereby, augments both own farm output and the marketable surplus from own-farm production, causes a shift from maize to millet production, and increases savings.

Participants in FFW increase own-farm production (including maize) in year 2 compared to year 1 and reduce the hours devoted to FFW activities. One might expect this decline to continue in future years as the opportunity costs of their time increases with the generation of additional capital to work within their own farm enterprises. This suggests that the FFW program itself may encourage a transition from FFW dependence to greater own-farm production in the long run. The existence of disincentive effects on own-farm employment and output were not found in this study. In fact,

according to the model used, the FFW program could be expanded by either increasing the monthly participation hours or the number of participants without resulting in any production disincentive.

On the consumption side, the primary effects of FFW are to increase the demand for food by participants as their income grows due to participation and related production response. Participants spend a larger portion of their increased income on food items as compared to non-participants. On the other hand, with regard to demand for leisure, increased income from participation would not lead to a reduction of work effort when compared to non-participants.

The other notable result is that the consumption of millet and sorghum is positively related to own price. This is clearly due to participation. It was established from the production results that participants expanded own production of millet, first, because of food received from FFW (year 1) and, second, because of income generated from sale of surpluses (year 2) which relaxed their capital constraint. Thus, raising the price of millet means increased income which, in turn, leads to increased own-consumption (provided the commodity is not "inferior").

In summary, food received under the FFW program has a significant positive effect on income by first contributing to meeting basic nutrient requirements, which in turn, lead to increased market surplus and second by relaxing the capital constraint farming. This means that small-subsistence farmers who are not faced with a labor

shortage can expand employment and output, gaining increased income and food for consumption. Most of the benefits to the representative participant households take the form of increased consumption of food items as compared to non-participants. Real income gains result in greater quantity and higher quality of food consumption. For example, a one percent increase in income resulted in a .57 percent increase in the budget share for meat, milk, eggs and fish for participants but only a .29 percent increase for non-participants. This, in turn, could lead to an improvement in nutritional status of participants. It seems that FFW insures participants' increased consumption without creating disincentives to either own-farming or to local agricultural production. Thus, participation in FFW has a highly desirable consequence for both production and employment behavior and for consumption patterns. In this study the magnitude of their relationship to FFW is established.

The results of this study are consistent with the hypothesized positive effect of food aid established in the conceptual arguments laid out by Austin and Wallerstein, Deaton, Maxwell and Singer, and Schuh, and a number of other authors. These authors have argued essentially that such targeted programs can augment the formation of human capital through their employment and income creating potentials which, in the long run, lead to the formation of productive human and physical capital.

VI.2.1. *Policy Implications*

The policy implication considered here is the effect of FFW on income and wealth distribution. The common question asked in this regard is, whether FFW facilitates the on-going process of inequitable size distribution of income (or growth). The majority of participants in Ewalel-Marigat locations are from the lower-income strata of the population. The results of this study clearly support the argument that FFW helps in narrowing the income gap between participants and non-participants. However, when one focuses on the question of who are likely to benefit the most among the participants, the income gains depend in large part on ownership of factors of production. The main determining factor for the realization of increased income from production, as shown here, is land. Since the distribution of this resource is unequal, so may be the benefits of FFW.[57] Professor Dorner once wrote:

> Under a system of private property, those who own the mean of production also receive the income from their use. Thus, the increased output is more or less automatically distributed in the very process of its production (1972, p. 21).

Thus, FFW program may lead to a wider income gap. Let us now explore this possibility in relation to the results found in this study.

Landless participant households operate no land and hence their behavior is not affected by the production segment of the model.[58] For

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[57] Although most farm households in Ewalel-Marigat area have common land, all arable land is privately owned.

[58] 11 percent of the final estimated sample was landless households.

the landless households FFW has no direct effect on their production. Their response to FFW participation is approximated only by the consumption side of the model (i.e., income from production is zero). On the production side, it is obvious enough that households with land benefit relatively more than the landless. However, households with land do not benefit equally since they have neither the same land size nor quality of land.[59] The effect of FFW is positively related to land size.

Although the participants (with land) are predicted to gain relatively more than the landless and non-participant households from FFW, some spill-over effects for both landless participants and non-participant households were predicted by the production model as well. These benefits resulted from the increased demand for hired labor. Participant households (with land) hired-in a total of 300 labor hours during the first year, and increased it to 578 labor hours (i.e., by 93 percent) in the second year of participation. For the landless participant households, this meant additional employment opportunities (i.e., in addition to their direct employment in FFW) and generated an additional income of 897 Kshs. Thus, *ceteris paribus*, even landless and non-participant households may share the benefits generated from the introduction of FFW program, but of course to a lesser extent.

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[59] Since data on quality of land was not reliable, it was not used for household classification.

It is established in this study that a price increase of millet and sorghum leads to greater earnings for farmers and, in turn, increased consumption of food items. This is only true for those households who produce millet and sorghum. The magnitude of these responses depend on the amount of land owned. Thus, while a price increase of millet and sorghum means increased consumption and may mean better nutritional status for those participants with land, it has a negative impact on both landless participants and all non-participant households.

On the other hand, a price decrease of millet and sorghum would cause FFW participant households to shift to producing other relatively higher priced commodities say maize. Here too, the participants (with land) will be the net gainers. Hence, in Ewalel-Marigat location there will be at least one commodity (among the locally produced) in which participants are the greatest beneficiary in terms of both consumption (nutrition) and income it generates; and the distribution of benefits among participants are directly related to the size of land holdings.

Finally, it was found that participation in FFW declines in subsequent years. The production model predicted that participation in the FFW program declines by 11 percent from year 1 to year 2. This has a major long run policy implication with respect to self-sufficiency. Exactly what the magnitude or speed of this decline might be would depend upon how much millet price (or even the price of any one of the locally produced crops) is increased in relation to other local prices, and what effect that would have on the availability of land.

VI.2.2 *Contribution of This Study and Implications for Future Research*

Contributions: The contributions of this study are in two areas, (a) it suggests answers to a number of questions that have been raised concerning FFW, and (b) it delineates a micro level approach for examining the impact of FFW. In various food conferences and seminars, a number of questions have been raised concerning the efficacy of FFW. Most recently, the UN/FAO/World Food Program Seminar on food aid expressed an urgent need for detailed project evaluation; and the challenges for future research were discussed under the broad areas of employment, agricultural production, nutrition, and status of women.

Given the economic environment of Ewalel-Marigat locations (discussed in Chapter II), and the assumptions used in constructing both the production and consumption models, the results found in this study suggests some answers. As shown in this study, when the targeted population (i.e., participants) is land-based, the total agricultural production in the area increases relatively more than it would otherwise. This in turn results in (a) a reduction of incentives for participation in FFW and (b) an expansion of employment by 93 percent above and beyond the direct employment in the FFW Project itself. Income (or working capital) and savings are significantly higher than they would be without the FFW. Income always augments the consumption of food in low income households. This is especially true in Ewalel-Marigat area where most of the benefits (excluding the

savings benefits) took the form of increased consumption of food items. The increased food consumption may mean improved nutritional and overall health status for adults and children, especially for low income households.

The results indicate that the FFW program contributes positively to local development efforts both in terms of employment and nutrition, and supports the theoretical argument made for FFW that eventually led to its inception in the 1970's. However, establishing the long-term efficacy of FFW requires longitudinal research that includes the effects of those inputs created by FFW (e.g. irrigation, nutrition) and encompasses a wide range of socio-economic variables and conditions. These concerns need to be explored in future research.

It is possible that one could dismiss the results of this study (outside the Ewalel-Marigat locations) on the basis of "uniqueness". It is true that this study is only one example, and the reader should exercise caution when interpreting the results. But, special case though it may be, one successful case is certainly more encouraging to proponents of this use of food aid than none. The success of the FFW Program in Ewalel-Marigat locations might be due to its integration into the existing agricultural and rural development projects, BPSAAP, rather than as separate projects. This is useful information for future project design.

The second contribution is in the area of methodology. This study extended the empirical applicability of the theory of the farm

household to households that are participating in FFW. Since FFW is designed to affect both production and consumption decisions, any effort to understand its effects must rest on models that integrate the two. On the production side, a linear programming (LP) approach suggested by Ahn *et. al.* (1981) was extended to a multi-year linear programming model so as to include FFW activities and their impacts on production in multi-crop economies. This approach (LP) allows consideration of specialization and the allocation of limited resources to competing farm activities including FFW. It also provides a framework for incorporating various aspects of risk, though this research did not attempt to do so. On the demand side, an Almost Ideal Demand System (AIDS), a flexible functional form, of Deaton and Muellbauer (1981) was used. Both these methods are easily manipulated and cheaply estimated both in terms of researcher and computer time.

Finally, unfortunately, neither the results presented nor the approach followed here could be compared to other related studies. This is because most studies on this subject have been mainly descriptive (e.g., Stevens, Aseffa, Ahmad) and address the impact of direct receipts of FFW. No study to our knowledge traces the impact of FFW on income and hence consumption vis-a-vis its effects on own-agricultural production.

Implications for Future Research: This research has demonstrated that FFW can accelerate both agricultural production by relaxing the capital constraint and improve consumption by directly

providing consumable items and by increasing the income of the recipient farm households. Much, however, remains to be explored.

One possibility is to compare the effects of FFW, such as found in this study with other project food aid programs (e.g., school feeding, education and training, and other direct nutrition programs). Since it is now very clear that food aid is a scarce resource item, future research must show the relative rates of return from such uses as FFW.[60] Here, of course, the difficulty is that the contribution of FFW to agricultural development is not immediately realized. When compared with other direct intervention programs, it requires long-term time series data to measure its effects. Our study is somewhat limited in this regard since it does not directly measure the long-term dynamics of FFW, due to lack of time series data. Our results are based on data from one growing season (one year) during which FFW was being used in the community.

Another research possibility will be in the area of "food" versus "cash". This issue is as old as the FFW program itself. In Ewalel-Marigat area, when participants were asked their preference there was not a single individual who preferred food over cash. All our sampled participants were, however, men. From the project designers point of view, food might be preferred on nutritional grounds. It has been argued that participants' families have a higher propensity to consume food when they are paid in food rather than cash

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[60] This point was recently discussed by Reutilinger in the WFP food aid seminar (1983).

(Reutilinger, 1983). This point is well taken when, in particular, participants are men. It has been shown that, when paid in money, men tend to spend relatively more on non-food items than women (Newberger, 1984). In any event, it is an issue that deserves more future research attention.

The last research issue addressed here is the potential use of FFW as food security insurance.[61] Future research should analyze the potential of FFW as a risk reducing factor in agricultural production. It is now a widely accepted fact that small farmers, subsistence farmers in particular, are relatively risk averse, and that they resist from adopting new techniques or inputs. If, however, they are assured of compensation for any crop failure resulting from the new techniques or inputs used, they are more likely to change their farming practices than they would otherwise be. In this case food would still be for work, but it would be used as a contingency payment (i.e., to fill the gap) in time of crop failure in order to secure farmers from disastrous nutritional consequences. The use of food in this sense not only cushions the development and adoption of new technology but also discourages out migration and provides incentives to the farm households to remain on the farm even during times of drought.

Future research ought to include "risk" measures on the production side of the model. The income level obtained from our production model is probably higher than the actual income realized.

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[61] This point was first raised by Austin and Wallerstein (1977).

This is due to the fact that production risks (i.e. variability in yield due to, for example, weather) are not taken into consideration. This is not, however, a weakness of the model but rather lack of data. For the demand side, one might consider the "Fourier" globally flexible form of Gallant (1981). This form was recently popularized by Wohlgenaut (1984) for being less restrictive than the AIDS when the interest is estimation of consumption behavior over time (i.e. when using time series data).

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APPENDIX A

SUMMARY STATISTICS OF FFW PROJECTS AND ENTERPRISE BUDGETS

Table 2.1

Summary of WFP Commitment to Projects in Kenya as of May 1982.

Project Type	Duration Period	Value (U.S.)*	Commodity (MT)
Food Assistance to Drought Affected People	1980	1,765,000	7200 wheat
	80/81	1,765,000	6300 wheat
	1981	1,765,000	6300 wheat
	81/82	21,160,000	7200 wheat
	1982	1,346,000	2500 wheat
			2500 maize**
Pre-primary and Primary School Feeding	81-86	14,037,000	40950 wheat
			3900 veg. oil
Rural Development & Settlement in Arid and Semi-Arid areas	81-82	2,025,000	6377 wheat
			180 veg. oil
	83-87	5,512,300	15961 wheat
			449 veg. oil
Dairy Development	83-85	23,116,000	15960 DSM
			2480 butter oil

*Includes International transporting maize

**In addition to wheat, 2500 (MT) of maize was also imported in 1982.

Table 2.2

Total Food Release from NCPB to BPSAAP as of October 1983

Date	Maize (MT)	Beans (MT)	Oil (Liters)
June - December 1982	200.00	13.00	1,960
January - December 1982	262.62	16.56	9,000
January - October 1983	400.00	26.00	18,000
Total release	862.62	55.56	28,960
Balance at NCPB Nakuru	200.00	13.00	1,960

Source: 1982 Progressive Report and Quarterly Reports of 1983.

Table 2.3

Total Food Utilization by Month in the Project Area

	ITEM		
Month	Maize (Kgm)	Beans (Kgm)	Oil (Liters)
Oct.	8820	810	208
Nov.	7200	360	160
Dec.	6120	1170	96
Jan.	4140	360	228
Feb.	4320	360	164
Mar.	17730	1980	764
Apr.	16740	1710	536
May	3915	360	140
June	10395	900	612
July	2475	225	96
Aug.	9540	741	302
Sept.	7965	648	228
Total	99360	9624	3534

Source: Food Collected from Marigat (AMS) Store to the Field (Official Record).

Table 2.4
Total Food Utilization by Month in the Study Area, 1982-83

Month	ITEM		
	Maize (Kgm)	Beans (Kgm)	Oil (Liters)
Oct.	7200	720	156
Nov.	3105	180	64
Dec.	3780	270	28
Jan.	No record	No record	No record
Feb.	2970	315	132
Mar.	11520	765	240
Apr.	12690	1080	368
May	3600	360	104
June	6435	585	174
July	2475	225	96
Aug.	7155	630	186
Sept.	6390	450	168
Total	68670	5580	1716

Source: Food Collected from Marigat (AMS) Store to the Field (Official Record).

Table 2.5

Activities that Utilized Food by Department in the Study Area (1982)

A. Soil and Water Conservation

Participation Period (Month)	Project Location	No. of Participants	Man/ Days	Type of Work	Work Done (Meters)
Jan.-Apr.	Sabor	60	56[a]	Stone check dam	2005
May	Sabor	30	3[a]	Stone check dam	43
June	Sabor	30	28[a]	Stone check dam	164.4
		3	5	Pit Latrines	3
Mid Jan-Apr.	Koriema	30	24	Stone Check dam	643
June	Koriema	30	31[a]	Stone check dam	822
Jan.-May	Kamuyei	30	85[a]	Stone check dam	1596
Jan.-Mid Apr.	Kibingor	30	67[a]	Stone check dam	1258
Apr.	Kibingor	30	600[b]	Tree holes	272 holes
Apr.-May	Kibingor	30		Planting trees	2765
	Kibingor	30	1200[b]	Fencing tree seedlings	
May	Kimalel	15	24[a]	Stone check dam	223
May	Kaptim	10	50	Cutoff drains	650
	Kaptim	4	50	Cutoff drains	260
June	Endao	30	600[b]	Watering Grassplot	-
Aug.	Endao	6	120[b]	Clearing survey Boundary lines	-
B. Crop Production					
July	Chemeron Irrigation Sch.	2	40[b]	Assisting irrigation Survey	-
Sept.	Eldume Irrigation Scheme	10	200[b]	Bush clearing	-
Sept.-Oct.	Marigat	3	120[b]	Misc. work	-
Nov.	Eldume Irrigation	10	200[b]	Stone check dam and laying gabions	-
C. Range					
March	Sabor	30	31	Access Tracks	4000
April	Sabor	30	30	Access Tracks	4000
May	Sabor	30	20	Access Tracks	2000
Jun.-Sep.	Sabor	2	160[b]	Maintaining the demonstration plot	N/A

Table 2.5 (Continued)

Participation Period (Month)	Project Location	No. of Participants	Man/ Days	Type of Work	Work Done (Meters)
March	Marigat	10	200[b]	Misc. work	-
Jun.-Sep.	Marigat	9	720[b]	Misc. work	-
Jun.-Sep.	Marigat	7	80	Watchman, at the hides & skins store	
Oct.-Dec.	Marigat	2	120[b]	General work	
May	Marigat	4	80[b]	General work	
April	Koriema	16	28	Fencing	1350
May	Koriema	16	31	Fencing	1400
Jun.-Sep.	Koriema	2	31	Fencing	370
Jun.-Sep.	Koriema	16	1280[b]	Constructing access road	-
Oct.-Dec.	Koriema	2	120[b]	Maintenance of range plot	-
Oct.-Dec.	Kilbingor	4	240[b]	Assisting group ranching	-
D. Forestry					
Mar.-Mid Apr.	Marigat			Nursery Watering	60,000 seeds
	Chemeron	130	3,900[b]	and pitting	20 ha.
Mid Apr.-May	Marigat Barsemii	130	3,900[b]	Planting	11 hs.
Jul.-Aug.	Barsemii	2	80	Guarding forest area	N/A
Oct.-Dec.	Barsemii	3	180[b]	Guarding forest area	N/A
Jul.-Aug.	Marigat	30	1200[b]	General nursery work	-
Oct.-Dec.	Marigat	42	2520[b]	General nursery work	-

Source: 1982 Progress Report of BPSAAP.

Note: a--These figures were calculated using an average of .63 meters per man per day.

b--These figures were based on 20 work days per man per month.

--All other figures (for man/days) were from 1982 Progress Report of BPSAAP.

(-) indicate data not available.

Table 2.6

Total Participation by Month in Man/Days

Month	Total Man/Days
October	1120
November	1260
December	1060
January	53
February	61
March	293
April	1297
May	875
June	1226
July	608
August	688
September	828
TOTAL	9369

Source: Calculated from Table (2.5 Activities that Utilized Food).

Table 4.1. Available Resources and Minimum Requirements for the Representative Farm Households.

Resources & Requirements	Constraint Level*	
	FFW Participants	Non-Participants
Land (Hectares)	2.75	3.31
Labor (man hours)**		
January	339	341
February	339	341
March	339	341
April	349	351
May	349	351
June	349	351
July	349	351
August	349	351
September	349	351
October	339	341
November	339	341
December	339	341
Minimum Food Requirements (Calories)		
Protein	112,420	
Fat	112,420	
Carbohydrates	549,325	

*The level of resource constraints for both traditional and low technology farms are the same.

**April through September includes 10 hours of children's labor since those household members between the ages of 7 and 14 do contribute significantly by herding livestock during the wet season. It was calculated using the average member of the household in this age group (7-14) and by assuming 5 hours work per day and 5 days per week.

Table 4.2. Estimated Output, Costs, Input Requirements, and Returns Per Hectare of Maize Under Traditional Technology (T1) and Low Technology (T2) for FFW-Participant Households.

Item	Unit	Quantity T1	Quantity T2	Price/unit* (kshs)	Total (kshs) T1	Total (kshs) T2
Gross Output	Kg.					
Maize		300	800	1.85*	555	1480
Total					555	1480
Variable costs**	Kg.					
Seed: Local		25	15	2.08	52.00***	31.20***
Improved		0	10	7.50	0.00	75.00
Fertilizer (Trichlorphon G 3.5%)		0	4	5.40	0.00	21.60
Work animal (Oxen)					350.00***	750.00***
Transport/Marketing					32.00	65.00
Total costs					434.00	890.20
Gross margin/hectare					121.00	590.00
Labor requirements: Mh						
January		0	0			
February		180	120			
March		340	310			
April		80	80			
May		0	0			
June		150	150			
July		65	65			
August		40	65			
September		0	0			
October		0	0			
November		0	0			
December		0	0			
Annual total		855	790			
Gross margin/man-hour					0.14	0.75

*Average price calculated as discussed in IV.5.2

**Obtained from Farm Management Division of the Ministry of Agriculture and Livestock Development.

***This figure is an opportunity cost since both the seed and work animal are mostly owned.

Table 4.3. Estimated Output, Costs, Input Requirements, and Returns Per Hectare of Millet Under Traditional Technology (T1) and Low Technology (T2) For FFW-Participant Households.

Item	Unit	Quantity T1	Quantity T2	Price/unit (kshs)	Total (kshs) T1	Total (kshs) T2
Gross Output	Kg.					
Millet		400	800	3.70*	1480.00	2960.00
Total					1480.00	2960.00
Variable costs**	Kg.					
Seed: Local		10	7	3.25	33.00***	22.75***
Improved		0	3	7.50	0.00	22.50
Fertilizer (Trichlorphon G 3.5%)		0	4	9.40	0.00	38.00
Work animal (Oxen)					350.00***	750.00***
Transport/Marketing					25.00	40.00
Total costs					408.00	873.25
Gross margin/hectare					1072.00	2086.00
Labor** requirements: Mh						
January		0	0			
February		180	120			
March		340	80			
April		80	80			
May		0	0			
June		150	150			
July		40	65			
August		60	85			
September		0	0			
October		0	0			
November		0	0			
December		0	0			
Annual total		850	580			
Gross margin/man-hour					1.26	3.60

*Average price calculated as discussed in IV.5.2

**Obtained from Farm Managerial Division of the Ministry of Agriculture and Livestock Development

***This figure is an opportunity cost since the seed and work animal are both owned.

Table 4.4. Estimated Output, Costs, Input Requirements, and Returns Per Hectare of Sorghum Under Traditional Technology (T1) and Low Technology (T2) For FFW-Participant Households.

Item	Unit	Quantity T1	Quantity T2	Price/unit* (kshs)	Total (kshs) T1	Total (kshs) T2
Gross Output	Kg.					
Sorghum		400	700	2.90*	1160.00	2030.00
Total					1160.00	2030.00
Variable costs**	Kg.					
Seed: Local		10	7	1.30	13.00***	9.10***
Improved		0	3	7.50	0.00	22.50
Fertilizer (Trichlorphon G 3.5%)		0	3	9.40	0.00	28.20
Work animal (Oxen)					350.00***	750.00***
Transport/Marketing					25.00	45.00
Total costs					388.00	854.80
Gross margin/hectare					772.00	1175.20
Labor requirements: Mh						
January		0	0			
February		180	80			
March		340	40			
April		85	85			
May		0	0			
June		150	150			
July		95	60			
August		300	400			
September		0	0			
October		0	0			
November		0	0			
December		0	0			
Annual total		1150	815			
Gross margin/man-hour					0.67	1.44

*Average price calculated as discussed in IV.5.2
**Obtained from Farm Management Division of the Ministry of Agriculture and Livestock Development
***This figure is an opportunity cost since both the seed and work animal are mostly owned.

Table 4.5. Estimated Output, Costs, Input Requirements, and Returns Per Adult Female Cow and Goat for FFW-Participant Households.

Enterprise:	Cow and Followers			Goat and Followers		
Item	Unit Quantity	Price/unit* (kshs)*	Total (kshs)	Quantity	Price/unit (kshs)*	Total (kshs)
Gross Output:	Kg.					
Milk	150	2.30	255.00	50	2.30	115.00
Meat	72	8.00	472.00	18	8.00	144.00
Total			92.00			259.00
Variable costs:**	Kg.					
Miscellaneous			40.00			20.00
Total			40.00			20.00
Gross margin			881.00			239.00
Labor** requirements:	Mh.					
January	50			12		
February	50			12		
March	50			12		
April	43			10		
May	43			10		
June	43			10		
July	43			10		
August	43			10		
September	43			10		
October	43			10		
November	50			12		
December	50			12		
Annual total	551			130		
Gross margin/ mh		1.60			1.84	

*Average price calculated as discussed in IV.5.2
**Obtained from Farm Management Division of the Ministry of Agriculture and Livestock Development

Table 4.6. FFW Ration and Labor Requirements

Length of Participation	Maize (kg)	Maize (kshs)*	Beans (kg)	Beans (kshs)*	Oil (kg)	Oil (kshs)*	Total (mh)	Total (kshs)
per day	2.25	4.15	0.2	1.05	.075	0.50	5	5.50
per week	11.25	20.80	1.0	5.25	.375	2.50	25	27.50
per month	45.00	83.25	4.0	21.00	1.500	10.00	100	114.25

*This conversion was done by simply using the average purchasing price, maize (1.85 kshs.), beans (4.25 kshs.), and oil (6.50 kshs.).

APPENDIX B

QUESTIONNAIRE DEVELOPMENT AND ENUMERATOR SELECTION AND TRAINING

Steps Taken in the Enumeration Process: Summary

Phase 1 - At VPI & SU:

In developing an effective questionnaire for eliciting the necessary data for the research objectives, the questionnaire was designed using secondary information, and pre-tested using a farm family in Virginia (the final-questionnaire is in Appendix C.)

Phase 2 - At Egerton College:

The questionnaire was revised to reflect the conditions of the selected study area. Here, information from WFP, BPSAAP and Egerton College (especially departments of Animal Science, Economics and Range) were very useful.

Phase 3 - At the Study Site:

With the help of Egerton College, the local chiefs and assistant chiefs of Ewalel and Marigat locations and BPSAAP officials, local enumerators were selected for training. The training was conducted in six stages:

First, the overall objectives of the research and the specific research problem being addressed were discussed. Then, the question of how the community benefits from such research and how the results could be disseminated to local policy makers was outlined. This stage was very crucial since local leaders (e.g., chiefs) and other supportive individuals (e.g. technical assistants from the Ministry of Agriculture) took part.

Second, the questionnaire was reviewed with the enumerators in its entirety (i.e., question by question). The emphasis here was to clarify the intent of each question. This was very

important since the questionnaire was written in English and the interview had to be conducted in "Kalenjin," the local dialect.

Third, the enumerators were asked to pair and interview each other. The results of this interview were reviewed and further clarifications were provided. At the end of this stage, the final 16 able enumerators were selected based on their ability as reflected in the trial enumeration process.

Fourth, these enumerators were sent to interview farm households around the Marigat area for the purpose of pre-testing. The final questionnaire was then prepared in light of the pre-testing interviews.

Fifth, each enumerator was assigned a specific sub-location to take a complete census of the study area. About 1,030 households (or 4,573 people) were identified.

The last stage was a relaxed, free question and answer session between the trainers and enumerators (in a somewhat get-to-know-each-other environment). The point here was to ease the relationship between these two groups, emphasize the reward for quality work, establish guidelines and procedures by which individual work would be evaluated. At the end of this session, the 300 sampled households were allocated among the enumerators, and the formal survey began.

Although monitoring each interview was done throughout the enumeration period, (three days a week), the first week of the formal survey was intensively monitored by the researchers and two other technical assistants from the BPSAAP. This step was

crucial in order to determine the level of communication of each enumerator. Each enumerator received feedback on their performance at least twice a week during the enumeration period.

APPENDIX C

HOUSEHOLD SURVEY - QUESTIONNAIRE

Household Survey in a FFW Project
Region of Baringo District, Kenya

Question I: Household Characteristics

Note: In this section we want to identify the number of people living in the household by sex, age, level of education, and relationship to the household head. We also want to know how long each individual has lived with this household within the last 12 months. If possible, we also would like to know the length of the time period each member of the household has been away from regular "work activities" because of sickness, holidays, or other ceremonial engagements while living in this household.

Ask the head of the household to fill in the table on "Household Characteristics." However, if he wishes, you can fill in the table by simply talking with the head while raising the points of interest as follows:

a) How many people live in your household?
b) Please tell me their first name, sex, age, school grade, relationship to you.
c) How long did each member live with you in the last 12 months?
d) How many days or weeks or months any of the members were unable to work because of sickness, holidays, or other ceremonial engagements?

*Note: Please include every person who lived with this household during the past 12 months.

TABLE: HOUSEHOLD CHARACTERISTICS

HOUSEHOLD CHARACTERISTICS					OTHER INFORMATION	
What Are The First Names Of The Head Of This Household And All Other Persons Who Are Living Here?	Relationship to Household Head	Sex	What Was The Age On The Last Birthday?	What Is The Highest Grade (or year) Of Regular School Ever Completed?	What Is The Length of Time Lived With This Household (specify if it is less than 12 months)?	What Is the Length Of Periods Within Last 12 Months You Were Unable To Work Because of Sickness, Holidays, Or Other Ceremonial Engagements?
Name (First)	Head	__ M __ F	______ Year	__ None __ Year		______ Days ______ Weeks ______ Month
Name (First)	__ Wife __ Own Child __ Other	__ M __ F	______ Year	__ None __ Year	______ Month	______ Days ______ Weeks ______ Month
Name (First)	__ Wife __ Own Child __ Other	__ M __ F	______ Year	__ None __ Year	______ Month	______ Days ______ Weeks ______ Month
Name (First)	__ Own Child __ Other	__ M __ F	______ Year	__ None __ Year	______ Month	______ Days ______ Weeks ______ Month
Name (First)	__ Own Child __ Other	__ M __ F	______ Year	__ None __ Year	______ Month	______ Days ______ Weeks ______ Month
Name (First)	__ Own Child __ Other	__ M __ F	______ Year	__ None __ Year	______ Month	______ Days ______ Weeks ______ Month
Name (First)	__ Own Child __ Other	__ M __ F	______ Year	__ None __ Year	______ Month	______ Days ______ Weeks ______ Month
Name (First)	__ Own Child __ Other	__ M __ F	______ Year	__ None __ Year	______ Month	______ Days ______ Weeks ______ Month
Name (First)	__ Own Child __ Other	__ M __ F	______ Year	__ None __ Year	______ Month	______ Days ______ Weeks ______ Month

Question II: General Information on FFW Participants

The following questions apply only to those households who participated in FFW projects. Ask the head of the household or the adult partcipant(s) member of the household, if the household head is not the one who participated, the following questions. If his family did not participate in FFW skip to section III, p. 6.

1. Number of family members who participated in FFW projects _____.

2. How did you come to participate?

   a. Applied for_____.
   b. Contacted by_____.

3. Which month(s) did you and/or members of your family work in FFW projects?
   NOTE: Be specific as to the particular 12 month period, just make a check in the appropriate month.

	Name	J	F	M	A	M	J	J	A	S	O	N	D
1.													
2.													
3.													
4.													
5.													

4. Why did you participate in the FFW project?

_____

_____

_____

   a) What were you doing at the time of your participation in FFW program?

      i) working in wage (or money) paying activity _____.
      ii) Working for relatives for subsistence food _____.
      iii) working on my farm _____.
      iv) Absolutly not working _____.

   b) Did you participate during the free time away from your work?

      Yes _____ No _____

      NOTE: Check only (a) or (b), not both!

5. a. If you were not participating this year, what could (or would) you have done during the periods you participated?

_____

_____

_____

Could you have found work elsewhere?

Yes _____ No _____

If "yes", where are you most likely to have found work?
_____ in village or nearby village
_____ in nearby town
_____ move to city

NOTE: Please identify participant's residence before and after participation in FFW projects using the follcwing questions (# 6,7, and 8).

6. Where did you come from?

a. From village where FFW project was located _____
b. From nearby town _____
c. From city _____
d. If (b) or (c) how far from the project village? _____

7. If you moved to the project village to work on FFW project, did you move back to where you came from?

Yes _____ No _____

8. Where are you living now?

Name of place _____.
Distance from the project village _____KM.

NOTE: Ask the participants to check one or more of the following sources of benefits from working in FFW projects. Participants could also list any additional benefits felt if they are not covered by our list below. Since these questions (i.e. #9 and 10) might deal with participants' "perceptions" do not spend too much time.

9. Did you gain any education or skill from participation in FFW projects?

Yes _____ No _____

If "yes", identify those areas where participant felt the gain, such as

a. Farm activities (specify) _____
b. Non-farm activities (specify) _____
c. Experience in working with group _____
d. Others (let participant identify or suggest) _____

If "no", explain to participant what is meant by "education or skill" from FFW using items listed under "yes" answer. If participant's answer is still "no", no skill or education must be recorded.

10. What additional benefits and costs did you experience (i.e. besides the food received for your labor) during the project? These should include such items as:

a. Cleaner or more dependable water service _____
b. Irrigation for your farm _____
c. Improved roads that reduce costs of marketing _____
d. Impact on local prices: Higher _____ Lower _____
e. Others (specify) _____
f. Compare, in your own way, participation with nonparticipation. Do you think your income (i.e. including skill, health) in the year in which you participated in FFW projects is greater than income in a year had you not participated?

NOTE: Here (i.e. 10 above) help the participants to think in terms of with and without FFW as opposed to before and after FFW.

11. Did your family consume all of the food received from FFW?

Yes _____ No _____

Did you exchange any of it for other products?

Yes _____ No _____

Did you sell any of it or buy some of it from others?

Yes _____ No _____

12. Would you like to participate in FFW projects again?

Yes _____ No _____

If "no", ask participant what it would take to make him participate again:

a. Cash-wage/hour _____ (kshs)
b. Food-wage/hour _____ (kgms)
c. Other benefits _____

Question III. Household Labor Use

Note: Here, we wish to know how houselold's time is allocated to farm and non-farm activities. More importantly, we want to know the amount of time spent on own farming, working for wage in either farm or non-farm work, and possibly on home activities and work for relatives. Whenever the household under study is a participant (or has participated) our interest is also to identify the amount of time spent on FFW projects. As shown in the table, "Household Labor Use," we want to identify the allocation of time by time period (or season).

Since this information requires recall you need to spend considerable time discussing how and when household time was allocated.

In filling out the table on "Household Labor Use" ask the head of the household (and, if possible, all the working family members) the following questions:

a) How many weeks did you work on your own farm, on another farm (for wage), on non-farm (for wage), at home, on non-wage work for relatives, and on FFW projects (only for those households that have participated in FFW projects)?

b) How many days out of those weeks on average did you actually work in the activities you mentioned above?

c) How many hours out of those days on average did you actually work in those activities you mentionad above?

Finally, complete table "work benefits" for those members of the household who have been employed as a salaried wage earner paid in cash or in kind.

TABLE: HOUSEHOLD LABOR USE

December–February

List Household Members Who Lived With The Household For Some Time Period In The Past 12 Months	Labor for Own Farming	Labor For Wage On Another Farm	Labor for Wage On Non-Farm	Non-wage Work For Relatives	Work at home (Includes home building & repairing, and child rearing	Work on FFW Projects (Type of Project ________)
Name: ________						
Weeks/month						
Days /week						
Hours/day						
Name: ________						
Weeks/month						
Days /week						
Hours/day						
Name: ________						
Weeks/month						
Days /week						
Hours/day						
Name: ________						
Weeks/month						
Days /week						
Hours/day						
Name: ________						
Weeks/month						
Days /week						
Hours/day						
Name: ________						
Weeks/month						
Days /week						
Hours/day						
Name: ________						
Weeks/month						
Days /week						
Hours/day						

TABLE: HOUSEHOLD LABOR USE

March - Mid April

List Household Members Who Lived With The Household For Some Time Period In The Past 12 Months	Labor for Own Farming	Labor For Wage On Another Farm	Labor for Wage On Non-Farm	Non-wage Work For Relatives	Work at home (Includes home building & repairing, and child rearing	Work on FFW Projects (Type of Project ______)
Name: ______						
Weeks/month						
Days /week						
Hours/day						
Name: ______						
Weeks/month						
Days /week						
Hours/day						
Name: ______						
Weeks/month						
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Hours/day						
Name: ______						
Weeks/month						
Days /week						
Hours/day						
Name: ______						
Weeks/month						
Days /week						
Hours/day						
Name: ______						
Weeks/month						
Days /week						
Hours/day						

TABLE: HOUSEHOLD LABOR USE

Mid-April - May

List Household Members Who Lived With The Household For Some Time Period In The Past 12 Months	Labor for Own Farming	Labor For Wage On Another Farm	Labor for Wage On Non-Farm	Non-wage Work For Relatives	Work at home (includes home building & repairing, and child rearing	Work on FFW Projects (Type of Project ____)
Name: ____						
Weeks/month						
Days /week						
Hours/day						
Name: ____						
Weeks/month						
Days /week						
Hours/day						
Name: ____						
Weeks/month						
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Name: ____						
Weeks/month						
Days /week						
Hours/day						
Name: ____						
Weeks/month						
Days /week						
Hours/day						
Name: ____						
Weeks/month						
Days /week						
Hours/day						

TABLE: HOUSEHOLD LABOR USE

June - August						
List Household Members Who Lived With The Household For Some Time Period In The Past 12 Months	Labor for Own Farming	Labor For Wage On Another Farm	Labor for Wage On Non-Farm	Non-wage Work For Relatives	Work at home (includes home building & repairing, and child rearing	Work on FFW Projects (Type of Project ______)
Name: ______						
Weeks/month						
Days /week						
Hours/day						
Name: ______						
Weeks/month						
Days /week						
Hours/day						
Name: ______						
Weeks/month						
Days /week						
Hours/day						
Name: ______						
Weeks/month						
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Hours/day						
Name: ______						
Weeks/month						
Days /week						
Hours/day						
Name: ______						
Weeks/month						
Days /week						
Hours/day						
Name: ______						
Weeks/month						
Days /week						
Hours/day						

TABLE: HOUSEHOLD LABOR USE

September

List Household Members Who Lived With The Household For Some Time Period In The Past 12 Months	Labor for Own Farming	Labor For Wage On Another Farm	Labor for Wage On Non-Farm	Non-wage Work For Relatives	Work at home (includes home building & repairing, and child rearing	Work on FFW Projects (Type of Project ______)
Name: ______						
Weeks/month						
Days /week						
Hours/day						
Name: ______						
Weeks/month						
Days /week						
Hours/day						
Name: ______						
Weeks/month						
Days /week						
Hours/day						
Name: ______						
Weeks/month						
Days /week						
Hours/day						
Name: ______						
Weeks/month						
Days /week						
Hours/day						
Name: ______						
Weeks/month						
Days /week						
Hours/day						
Name: ______						
Weeks/month						
Days /week						
Hours/day						

TABLE: HOUSEHOLD LABOR USE

October - November

List Household Members Who Lived With The Household For Some Time Period In The Past 12 Months	Labor for Own Farming	Labor For Wage On Another Farm	Labor for Wage On Non-Farm	Non-wage Work For Relatives	Work at home (Includes home building & repairing, and child rearing	Work on FFW Projects (Type of Project ________)
Name: ________						
Weeks/month						
Days /week						
Hours/day						
Name: ________						
Weeks/month						
Days /week						
Hours/day						
Name: ________						
Weeks/month						
Days /week						
Hours/day						
Name: ________						
Weeks/month						
Days /week						
Hours/day						
Name: ________						
Weeks/month						
Days /week						
Hours/day						
Name: ________						
Weeks/month						
Days /week						
Hours/day						
Name: ________						
Weeks/month						
Days /week						
Hours/day						

Table: WORK BENEFITS

If any member of the household has worked for cash or in-kind (from Table Household Labor Use) enter detail information in this table.

Name of member same as "Household Labor Use"	Occupation (type of work)	Cash Received (kshs.)	In-Kind Benefits	
			Food from FFW (kgms.)	Others (specify)

Question IV: Farm-Production (Crops)

NOTE: The folowing questions are for those households who farmed and produced one or more crops from their own or rented land within the last 12 months.

1. Determine the total available land of the household (approximate only) by type.

Land Type	Land Owned (Hectare)	Land Rented (Hectare)	Season	Season
Good Cropland (i.e. cultivable)				
Poor Cropland				
Irrigated land				
Pasture land				
Others (specify)				

2. Ask the farmer the amount he and his family members (as a household) produced or harvested, consumed, sold, donated and stored within a single production cycle (i.e. one year). For each crop, fill in details in the table "Crops Harvested" on the next page (Season I and Season II separately).

TABLE: CROPS HARVESTED

Enter All Crops Grown on the Table Below: Season _____. Then Ask Questions on Quantity Harvested, and Disposal (or use) of Crops.

List All Crops Grown by the Farm Household Name of Crop	Quantity Harvested		Disposal of Harvest			Quantity Sold	
	Unit	Quantity	Quantity Consumed	Quantity in Store	Quantity Donated to Relatives or Other	Quantity	Price/Value
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							

CROPS HARVESTED

Enter All Crops Grown on the Table Below: Season _____. Then Ask Questions on Quantity Harvested, and Disposal (or use) of Crops.

List All Crops Grown by the Farm Household	Quantity Harvested		Disposal of Harvest			Quantity Sold	
Name of Crop	Unit	Quantity	Quantity Consumed	Quantity in Store	Quantity Donated to Relatives or Other	Quantity	Price/Value
11.							
12.							
13.							
14.							
15.							
16.							
17.							
18.							
19.							
20.							

3. Ask the farmer the source (i.e. family or hired labor), Amount used and the cost (if hired). Enter this information by crops, on the table "Labor Requirement" below.

TABLE: LABOR-REQUIREMENT

NAME OF CROP	LABOR USED			
	Own Family Labor	Relative or Community Labor	Hired Labor	Cost/kshs.
1. _____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____
2. _____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____
3. _____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____
4. _____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr. Wk. ____
5. _____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____
6. _____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____
7. _____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____
8. _____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr./WK. ____
9. _____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____
10. _____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____	Mo./Yr. ____ Wk./Mo. ____ Hr./Wk. ____

4. Before asking the farmer the implements he/she used in production of the particular product ask the farmer which of the following implements were available for the household within the last 12 months. (Check from list below and circle):

1. Hoe
2. Axe
3. Fork
4. Spade/shovel
5. Pick
6. Sickle
7. Adze
8. Spray pump
9. Wooden hand sheller
10. Metal hand sheller
11. Hand powered grinder
12. Hand powered water pump
13. Wheel barrow
14. Ox (oxen)
15. Other draft animal
    Specify _____
16. Ox-plough
17. Ox-harrow
18. Ox-planter
19. Ox-cultivator
20. Ox-cart
21. Ridger
22. Two wheel tractor (Rotavator)
23. Tractor
24. Trace plough
25. Tractor-harrow
26. Tractor-planter
27. Trailer
28. Water pump engine
29. Others (specify) _____
30. _____
31. _____
32. _____
33. _____

5. For all of the implements owned, enter detail information below:

Name of Implement Enter #'s from above.	Number owned	How long since owned (mo./yr.)	How obtained (all sources) 1/ Enter #'s below	If purchased amount paid (kshs.)**	If purchased, source of cash 2/ Enter #'s below	If borrowed, Interest rate (kshs.)	Number of other Households sharing implements

1/ How obtained

35. Bought
36. Given as gift
37. Exchanged
38. Inherited
39. Self-made

2/ Sources of Cash

40. Own savings
41. Relative
42. Commercial Bank
43. Agricultural Development Bank
44. Local Credit Union
45. Religious Association
46. Other (specify) _____

** Specify the month/year purchased

6. For all of the implements Rented-in by the farm household, enter detail information below:

Name of Implement	Number rented	How long rented (Mo./Yr.)	Method of Payment 3/	Total Cost (kshs.)

3/ Method of Payment

47. Cash
48. In-kind
    a) Food (Grains)
    b) Work (Labor)

7. For all of the implements Hired-out and lent to other farmers within the single production cycle (i.e. within 12 month production cycle), enter detailed information below:

Name of Implement	Number Hired-out	How long Hired-out (Mo./Yr.)	Method of Payments 3/ **	Total Receipts (kshs.)

** Use key on previous page.

8. Identify types of capital implements (or inputs) used in producing those crops you have listed (i.e. for the same crops listed in tables "Crops Harvested" and "Labor-Requirement").

TABLE: CAPITAL-IMPLEMENT BY CROPS

Name of Crop	Amount of land used. (Hectare)	Name of Implem. Enter only #'s from #4 above.	Seeds		Fertilizer		Insecticides	
			Quantity (kgms.)	Cost (kshs.)	Quantity (kgms.)	Cost (kshs.)	Quantity (kgms.)	Cost (kshs.)

9. If the farmer hired labor ask him in which month he hired and how much he paid per month or per week, or per day, or per hour, in whatever unit of time the farmer feels comfortable, and enter the total by filling in the table below.

Farm Activity	J	F	M	A	M	J	J	A	S	O	N	D	Total Cost of Hired Labor (KSHS.)
Land Preparation KSHS													
Planting KSHS													
Weeding KSHS													
Harvesting KSHS													
Other KSHS													
Total Cost of Hired Labor (KSHS.)													

10. If the farmer purchases seed, fertilizer and insecticides, and hired (or rented) machinery (or tools) ask him in which month he hired or rented and how much he paid. Fill in the table below.

Item	J	F	M	A	M	J	J	A	S	O	N	D	Totals Kgms.	Totals Kshs.
Seeds: Quantity (Kgms)														
Cost (Kshs)														
Fertilizer: Quantity (Kgms)														
Cost (Kshs)														
Insecticides: Quantity (Kgms)														
Cost (Kshs)														
Machinery (or other tools) Cost (Kshs)														
Totals (Kshs)														

11. Ask the farmer if he puchased any other items for his farm during the last production period and if so at what cost?

    Items _____

    Cost (Kshs) _____

12. Fianlly, ask the farmer which month(s) he and his family members have to work the hardest on the farm.

    List here _____ _____ _____ _____ _____

    _____ _____ _____ _____ _____

Question V: LIVESTOCK

NOTE: Here, we want to know whether the household has owned any livestock during the past 12 months.

1. Ask the household which livestock are owned (check from list below and circle), and enter the number of livestock owned.

Name	Number Owned
Cow (Dairy)	
Chicken	
Sheep	
Goat	
Donkey	
Horse	
Mule	

Other (specify) _____

_____

2. If the household owns any livestock then fill-in detail information below by asking the household the main feed items and other inputs for livestock and the approximate cost (if purchased).

Feed Items	Cost (KSHS.)

Other inputs (such as sprays, dips, etc.)

_____

_____

3. If the household owns any Diary-cow, then ask the amount of milk produced and the use of it during the past 12 months.

Amount Produced (kgms.)	Amount used in the home (kgms.)	Amount sold (kgms.)	Price/Value (kshs.)

Question VI: Others-Household's Source of Income

Ask the household whether there were any sales during the last 12 months, of livestock (as listed in #1 above) and other items (such as eggs and milk), home produced items (such as food, crafts), assets (such as land, house, business, etc), and other products from fishing and hunting activities.

Enter the information below:

Name of item	Quantity Sold	Specific Unit	Price/Value (kshs.)
Livestock:			
Eggs:			
Milk:			
Home Produced Items:			
Assets:			
Fishing:			
Hunting:			

Question VII. Annual-Total Household Income

NOTE: In this section we want to know the annual total income of the household by source and month as shown in the Table "Annual Total Household Income." Ask, if possible, each working family member their income from each source.

The column "From Other Sources" includes: Pension, Rent, Interest from savings, Gifts, etc.

Complete the Table "Annual Total Household Income" by going through each month.

In this table any food-crops received from either FFW projects or any other sources, such as relatives, are considered Income. Therefore, be sure to enter first the quantity in the appropriate column, and then indicate the amount sold, if any, out of that quantity in the same column including the total value received or the price per unit received. If the space provided is not enough, use the back of the table.

TABLE: ANNUAL - TOTAL HOUSEHOLD INCOME

	Farm Labor				From Sale of Crops*	From Other Sources (i.e. non-crop, non-wage	Total	
	Wage (kshs)	Food From FFW Projects (kgms)	Money or Food From Relatives (Kshs)	(Kgms)	(Kshs)	(kshs)	kshs	kgms
Dec.-Feb.								
Dec.								
Jan.								
Feb.								
Mar-Mid-Apr.								
March								
April								
Mid-Apr-May								
May								
June-August								
June								
July								
August								
September								
Oct.-Nov.								
Oct.								
Nov.								
Totals								

*Ask only the head of the household the total income from crops sale last year(19__), and enter it here (kshs) _____.

NOTE: Be sure the time period here is the same 12 month period used throughout the questionnaire.

Question VIII: Items Purchased and Total Expenditures of the Household

NOTE: In this section we want to identify all the farm goods and non-farm goods that were purchased by the household within the last 12 months. Also, we would like to know how much the household paid for these items.

In order to fill in the table on "Items Purchased and Total Expenditures" (next page), ask the head of the household and the wife in particular to identify all the items purchased and the approximate cost by month, and if possible, the approximate quantity as well.

TABLE: ITEMS PURCHASED AND TOTAL EXPENDITURES

MONTH: _____

Expenditure Groups	Quantity (specify the unit)	Cost (kshs.)
Farm Products I. Food (all crops)		
II. Dairy Products		
Non-Farm Products III. Clothing		
IV. Shelter Maintenence		
V. Toilet Articles		

TABLE: (cont.)

Expenditure Groups	Quantity (specify the unit)	Cost (kshs.)
VI. Rent & Other Rates (i.e. water, lighting)		
VII. Fuels (i.e. Charcoal, wood, parafin)		
VIII. Transport		
IX. Education Expense (i.e. fees, books,etc.)		
X. Medical Expense		
XI. Livestock		

TABLE: (cont.)

Expenditure Group	Quantity (specify the unit)	Cost (kshs.)
XII. Household Durable (i.e. radio, chair, cook ware.		
XIII. Storage Expense		
XIV. Taxes		
XV. Remittence & Gifts made.		
XVI. Miscellaneous Household Expenses.		
XVII. Miscellaneous Farming Expenses.		

Question IX: SAVINGS

Finally, please ask the head of the household whether he/she and any other member of the family has saved any money. In otherwords, ask the head of the household (and other family member if separately saved) how much money do they have in their savings at the time of this interview.

Fill in the information below.

1. Household's total current savings (kshs.) _____

2. Approximate period it took to save this amount (month/year) _____

_____.

ENUMERATORS NOTES

Read the questionaire fully before each day you go-out to ask the households.

Learn how to ask the questions from the questionaire you have just completed. Don't ask (or use) those questions that seem irrelevant to the particular household because of what he has already told you.

Remember: Each question in the questionnaire could be asked in many different ways. Therefore, you may have to approach a single question in different ways as you see it fit to that particular household you are asking.

Important: BE yourself! BE friendly! Make sure you are approaching the head of the household as if you are talking and discussing instead of simply questioning or interviewing him/her. Try to BE as if you are one of the neighbors in the village.

The head of the household whom you are asking may missunderstand the question you are asking. As a result he/she might be discussing or telling you information that may not have any relevance to the particular information you are after. Whenever this happens, you simply pretend as if what he/she is telling you has some relevance but continue to guide him/her to the right direciton by simplifying the question.

Specific Question Notes:

Question I: This question is straight forward. Sit with the head of the household and complete the table.

Question II.(#'s 1-12): Use these questions for those households which participate in FFW Projects. If one or more family members participated within the last 12 months, we call this a participant household. Make sure you talk to the family member who actually participated in FFW Projects.

Question III: This section is straight forward. Read the NOTE under this section carefully.

Question IV: #1. In completing this table you only need to ask the farmer the ranges of hectares (e.g. 0-.25, .25-.5, .5-.75, etc.). The farmer may not know the exact land size. Make sure you specify the unit by which the land is measured (such as hectare, acre, square meter).

#2. When you are completing this table make sure you specify the quantity in terms of units that are known (i.e. units that can be converted).

#'s 3 & 9. When you ask the farmer about the cost of hired labor you must give the farmer the opportunity to answer either column "Cost/kshs" in question #3 or the table of question #9. Note that the reason of having question 9 (table) is only to assist the farmer to recall or remember the cost of hired labor by activities and month. Either way, only the total figure matters. Of course, to have both tables filled will be desirable but not

crucial. #9 could be optional.

#'s 8 & 10. Having #10 follows the same reasoning as above. In otherwords, #10 is to assist the respondent in recalling the information (it is an optional). #8 however, must be completed. While filling this table, you must have the list of implements (#4) in-front of you. Under the column of "Name of Implement" enter only the number that corresponds to each implement.

#4. Is just a list of implements. You have to circle all the available implements for at least one agricultural production cycle (i.e. 12 month period) regardless of the source (i.e. either owned or rented).

5 & 7. Using #4, these tables ask straight forward questions. You simply complete those tables with the head of the household. Use Tables in #5 and in #6 for owned and rented implements respectively. Use the table in #7 for those implements that have been hired-out and/or lent to other farmers.

#'s 11 & 12 are additional questions.

Question V: is straight forward section.

Question VI: Here, you need to list the items that were sold by the household within the last 12 months. Try to get at least an approximate average quantity and price (or value) for each item you listed. Do not forget to specify the unit of measurment. It is very crucial.

Question VII: Having this table by month and by major work activity is to assist the household in recalling information on income. Here you may want the head of the household to tell you the easiest way to divide the year so that it would be easier to recall. In that case the division on months as shown in the Table "Annual-total Household Income" may or may not be useful. Whatever you use in adjusting the periods make sure you keep the same sources. NOTE: We are only after the total income from each source.

Question VIII: This section must be completed for each month. When you ask the household to recall what they have spent on items they have listed tell them you are only interested in the average cost. Make sure you explain what you mean by "average". Since some items are difficult to quantify do not spend neither yours nor the household's time trying to figure out the quantity of the item. You can leave it blank. For those quantifiable items, however, make sure to specify some known measurement units (such as killograms, pounds, yards, itc.) What is important in this section, is the amount spent (i.e. cost). You must take your time with the respondent of the household and get the approximate-average cost for each item purchased.

Question IX: is straight forward.

ADDITIONAL REMARKS:

1. If you see a space with //////// , leave it blank, i.e. do not write anything on it.

2. Anytime you write quantity do not forget to specify the unit of that quantity.

3. Whenever the space provided for the particular question is not sufficient to write the required information use the back of the page or attach a separate sheet.

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