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ABSTRACT

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The enormous amount of food aid received by Ethiopia since 1984/85 famine has raised concerns about potential adverse effects of food aid on agricultural production. By using large household survey data in 1996 from rural Ethiopia, I examine food aid's effects on two types of major household behavior: child labor supply and crop marketing. In Chapter 3, I determine food aid's effects, as well as household composition's effects, on child farm labor supply controlling for household fixed effects by using conditional logits. The results indicate that a child, especially a boy, has higher probability of working on farm if he or she is living with younger children. The results on food aid's effects also indicate that different types of food aid programs — free distribution and food for work — have different effects on the probabilities of boys and girls working on farm. In Chapter 4, I determine food aid's effects on crop sales and purchases by using instrumental variable models. The results indicate that receiving cereals (mainly wheat) from food for work projects decreases wheat purchases. Thus, using wheat as payments at food for work projects may discourage local wheat production by decreasing wheat purchases and market prices.

To Wendy and my parents*

* I would like to dedicate Chapter 3 to my father, who lost his mother at age 5 and had to start working as child labor at coal mines, his uncle's farm, and other places. He did not finish elementary school. He later migrated to a large city, Osaka, and raised his three children with his wife. His life has been the best and most optimistic textbook on development economics, which is probably why I am in this field.

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Chapter 1

INTRODUCTION

After two major famines in 1973/74 and 1984/85, Ethiopia has been receiving enormous amount of food aid. Despite the humanitarian success of food aid, the large volume of food aid compared to Ethiopia's grain production has raised concerns on food aid's adverse effects on agricultural production. Food aid may help Ethiopian people in the short-run but may harm their agricultural development and create food aid dependency in the long-run. Among many potential adverse effects of food aid, two major effects have been discussed over decades: food aid's disincentive effects on labor supply and effects on crop prices. In spite of these concerns, household level studies on food aid's effects on various economic activities are limited, partially due to lack of large scale household surveys.

The purpose of this dissertation is, therefore, to determine food aid's effects on two types of household behavior: child labor supply and crop marketing. To achieve this purpose, I use newly available household survey data in 1996 from rural Ethiopia. The main household survey contains information on 4,128 households.

Although food aid was thought to discourage labor supply on farm production by providing cereals and cooking oil directly to households and by providing employment opportunities outside farm production, policy implications for providing food aid will be different depending on whose labor supply is influenced by food aid. In rural Ethiopia

children work extensively on farm. Farm work was cited by rural households as the single most important reason for not sending their children to schools (the World Bank, 1998). If food aid reduces child labor supply, then the welfare standard of households may improve despite some production loss in farm production as a result of reduced child labor supply. In Chapter 3, I estimate the differential effects of food aid on child labor supply between boys and girls, boys and female adults, and girls and female adults.

Another important potential adverse effect of food aid is the effects on food crop prices: increases in food supplies provided by food aid depress prices received by farmers. When food aid is provided to households directly, the only way that food aid can have price effects is through households. Thus, to examine the potential price effects, we need to estimate the effects of food aid on recipient households' crop marketing. This is exactly what I do in Chapter 4.

The results from these analyses will help food aid recipient governments and donors to understand food aid's potential effects on agricultural production and help them to mitigate any adverse effects, if they exist. The rest of this dissertation is organized as follows: Chapter 2 describes food aid distribution and provides some empirical evidence of food aid targeting in rural Ethiopia. Chapter 3 presents an analysis of food aid's differential effects on child labor supply. Food aid's effects on crop marketing are examined in Chapter 4. Finally, conclusions are in Chapter 5.

Chapter 2

FOOD AID IN RURAL ETHIOPIA

In this chapter I describe food aid distribution in rural Ethiopia. The purpose of this chapter is to provide all important information that will help readers to understand the following chapters. Some materials in this chapter come from a previous study on food aid targeting, Jayne, Strauss, Yamano, and Molla (2000), which examine food aid targeting at regional and household levels in detail.

2.1. Historical Trend

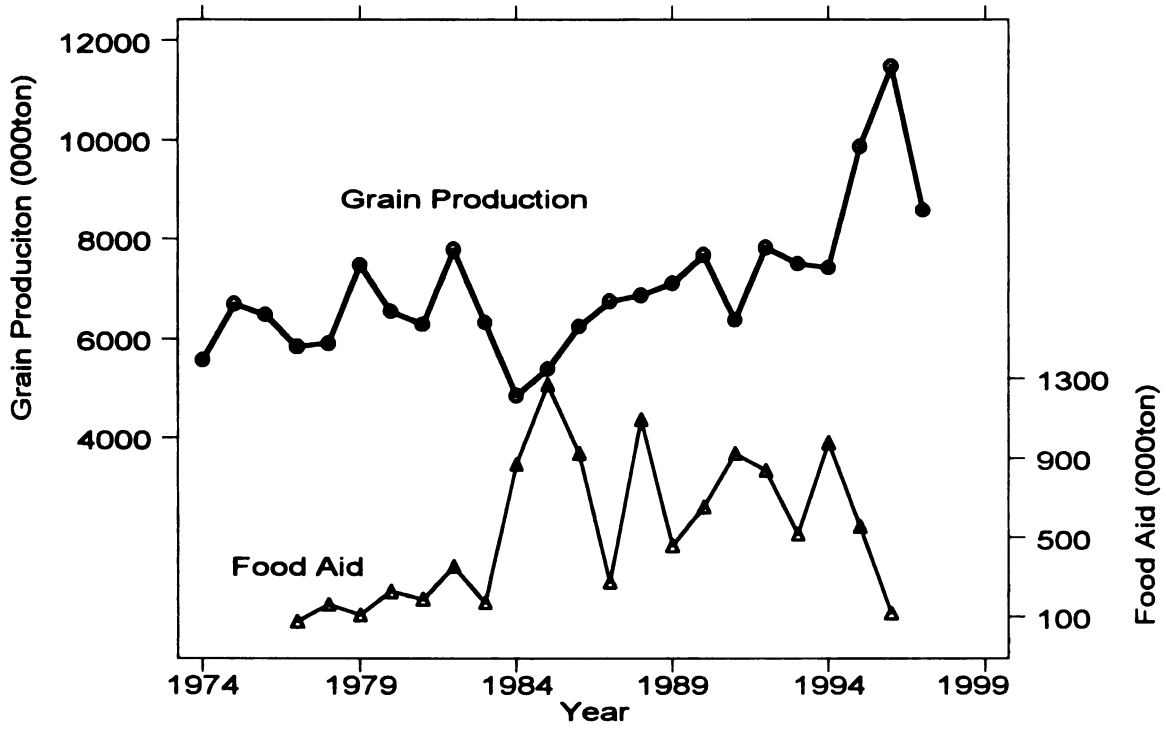
Ethiopia has suffered two major famines in the past twenty-five years, in 1973/74 and 1984/85. The disasters of 1973/74 and 1984/85 came after a series of poor economic policies and droughts over many years. The 1973/74 famine is said to have claimed the lives of over 250,000 people (Sen, 1981). A severe drought occurred in 1984 while many parts of Ethiopia were suffering through poor rainfall for many years. Almost 8 million Ethiopians were affected by food shortage during the famine crisis, and an excess death toll of 1 million is widely quoted, although the figure of 1 million cannot be verified (de Waal, 1991; Webb, von Braun, and Yohannes, 1992; von Braun, Teklu, and Webb, 1998).

After the two major famines, Ethiopia has received enormous amounts of food aid over the past several decades. Ethiopia received 200,000 metric tons to about 1.2 million tons of food aid or between 3.5 and 26 percent as a proportion of total domestic food

grain production over the 1985-96 period (Clay, Molla, and Habtewold, 1999). In the late 1980s, Ethiopia was receiving roughly 25 percent of all food aid delivered to Africa and was still receiving 22.5 percent as late as 1998 (WFP, 2000).

In Figure 2.1, we plot the national grain production and the amount of food aid received with different scales. As one can see, the amount of food aid increased in 1984 and 1985 as grain production dropped sharply in 1983 and 1984. The amount of food aid reached its peak in 1985 at 1.3 million tons, which was roughly 26 percent of the grain production in 1985. Although the grain production has increased after 1984, the amount of food aid remained at high level between 1988 and 1994. This high level of food aid deliveries can be partially explained by the shift of rationale for food aid from emergency relief to rehabilitation (Webb, von Braun, and Yohhanes, 1992). At the beginning, the focus of food aid programs was on the short-term objectives of saving lives (emergency relief), rather than on long-term development objectives (rehabilitation). By the early 1990s, such efforts to "link relief to development" became popularized and integrated into the food aid programs of both donors and the governments (Clay, Molla, and Habtewold, 1999).

Figure 2.1. Annual Grain Production and Food Aid in Ethiopia, 1974-1997



2.2. Data

Given this information at macro level, now we turn our interests to micro level food aid distributions. The data come from the 1996 Food Security Survey (FSS), fielded on a subset of 1996 Agricultural Sample Survey (ASS) households. In addition, monthly rainfall data were taken from 40 rainfall stations distributed throughout Ethiopia and matched to the locations of the household samples. The ASS used the same frame of enumeration areas (EAs) as used to conduct the 1994 Population Census. The ASS randomly selected 25 households in each sampled EA. Out of these, 15 were selected for the collection of more detailed field-crop information, including actual measurement of fields and cutting and weighing of crops from the Meher (main) season. Separately, the Food Security Survey (FSS) randomly selected 7 out of 25 households in the ASS sample, total of 4,112 households. Only 2,867 FSS sample households have detailed crop-cut information. Because we use crop-cut data to construct the income variable in this chapter, we use information on 2,867 households (see Jayne, Strauss, Yamano, and Molla, 2000 for details). According to Figure 2.1, we can see that the grain production reached its highest level and the amount of food aid declined sharply in 1996. This indicates that the data we use were collected in a good year, and the following empirical evidence may not represent situations in bad years. Although as we describe later, food aid distribution shows resistance to change over years.

Table 2.1 shows income and food aid distribution in rural Ethiopia by domain. Column (a) has the domain mean of household per capita gross income. Household gross income is the sum of production value for food crops in the 1995 Meher growing season

Table 2.1. Food Aid distribution in Ethiopia, 1995/96.

Killil [A]	Domain	Number of sampled		Mean per capita income	Percent of sampled households in the bottom national income quartile[B] (b)	Percent of households considered vulnerable in 1984/85[C]	Percent of sampled households who received Free Distributions or Food For Work	Mean value of per capita food aid received, both Free Distributions and Food For Work
		Weredas	Households	(a)		(c)	(d)	(e)
		number	number	– birr –		---------- percent ---------		– birr –
Tigray	all	31	162	546.7	15	60	55	41
Amhara	N. and S. Gonder	17	154	421.5	18	11	21	16
	E. and W. Gojam, Agewawi	31	234	562.3	17	2	2	1
	N. Wello, Wag Hamra	13	178	356.0	23	93	69	43
	S. Wello, Oromiya, N. Shewa	31	194	458.5	19	46	35	11
Oromiya	E. and W. Wollega	32	219	451.0	29	0	6	1
	Illubabor, Jima	29	223	672.7	11	0	4	0
	N. and W. Shewa	30	198	674.8	6	1	9	1
	E. Shewa, Arsi, Bale, Borena	30	183	704.1	16	8	13	2
	E. and W. Harerge	18	135	371.2	33	16	16	5
Southern (SNNPR/ SEPA)	Yem, Kefficho, Maji, Shekicho	15	180	449.3	24	0	2	2
	N.&S.Omo, Derashe, Konso	20	179	212.4	66	9	26	1
	Hadiya, Gurage, Kembata	16	175	328.9	39	4	22	0
	Sidama, Gedeo, Burji, Amaro	14	125	488.3	26	1	6	8
Others		21	328	494.2	34	10	22	9
Total		348	2,867	487.7	25	17	20	9

Note:A) Killil is the largest regional unit in Ethiopia. These are disaagregated into "domains," an amalgam of zones, which constitute the next highest regional unit. Weredas are relatively small regional units. There are approximately 1,000 weredas in Ethiopia. B) Income quartile is calculated nationally. C) As determined by the Government Disaster Prevention and Preparedness Commission (and its government precursors). D) Others include Somali, Benishangul, Gumuz, Gambela, Harari, Addis Ababa, and Dire Dawa.

(harvest typically being from September through December) taken from crop cuttings;[1] plus self-reported production value in 1995 for non-food crops such as coffee (no field cuttings were taken for these crops); less cash costs for all crops combined (which is mostly fertilizer costs); plus 20 percent of the value of livestock as an approximation to livestock income; plus an estimate of off-farm cash income contributed by each household member over the past year prior to the survey. We calculated percentages of households in the bottom quartile for each domain by using household level gross income (column b).

The FSS survey asked whether at least one household member participated in food aid programs. If yes, the type of food aid program, free distribution (FD) or food-for-work (FFW), and the type of commodity provided were recorded. Furthermore, the quantity of commodity received was asked for each month between June 1995 through May 1996. The quantities received were converted into values by using conversion factors and regional level prices. All information on food aid is at household level. Column (d) shows domain mean percentages of households who received some food aid. On average 20 percent of households received some food aid.

Before we describe food aid programs in detail in next section, it is worth pointing out one interesting feature of food aid distribution in rural Ethiopia. Column (c) and (d) in Table 1 indicate that weredas where 1984/85 famine had hit the hardest received high level of food aid in 1995/96. The column (c) of Table 1 has percentages of households

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[1] Self-reports are also available, however CSA considered the crop cut data to be more reliable. This is because self-reports of production are reported in many different local units, and to convert into a common unit such as kilograms, one has to use CSA gathered conversion factors of uncertain reliability.

considered vulnerable in 1984/85 by the Ethiopia Relief and Rehabilitation Commission (RRC), the precursor to the current Disaster Prevention and Preparedness Commission (DPPC). The RRC estimated the severity of the food situation in each year, measured as the proportion of that "need" food aid. The definition of "need" is not clear though. The numbers in column (c) is the average proportion of households considered in "need" in 1984 and 1985. The numbers in column (d) indicate the percentages of households who received some food aid. As one can see, the numbers in column (c) and (d) are closely correlated.

Jayne, Strauss, Yamano, and Molla (2000) posed two hypotheses on this close correlation between the proportion of households considered in need during 1984/85 famine and the percent of households received food aid in 1995/96. One hypothesis is the "chronic needs" hypothesis that households who live in areas where 1984/85 famine had hit the hardest are still in poverty and are food insecure in 1995/96. The other hypothesis is the "inertia" hypothesis that food aid program operations or allocation procedures may possess fixed costs — or inertia — which create rigidities in the spatial pattern of food aid distribution. Although Jayne, Strauss, Yamano, and Molla (2000) examined these two hypotheses throughly, neither hypothesis could be rejected.

2.3. Types of Food Aid

2.3.1. Free Distribution and Food For Work

Food aid in Ethiopia has historically taken two major forms (Webb and von Braun, 1994; Webb, von Braun, Yohannes, 1992): free distribution (FD), which falls under the

category "emergency" distribution, and food for work (FFW).[2] Most FFW activities are categorized as "development" food aid programs since they focus on developing assets such as roads, terraces, and dams.[3]

Free Distribution (FD)

FD programs in Ethiopia distribute cereals and cooking oil directly to households.[4] Food aid allocations are made in two stages: from federal authorities to *weredas* (which are roughly akin to a county); and from weredas to local Peasant Associations which distribute the food to beneficiaries. The administrative mechanisms used at each level are distinct (Sharp, 1997). In the first stage, the wereda administration determines the number of households "in need" within each wereda.[5] These assessments are forwarded to and revised by the Zonal and Regional Administrations, and ultimately the federal-level Disaster Prevention and Preparedness Commission (DPPC). The DPPC then revises

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[2] A third form, cash for work, has been used only sparingly in Ethiopia and is not addressed here. Also, so-called "program" food aid, which is food that is sold on local markets (not directly given to households) for local currency which is then used for general budget support, has not been much used in Ethiopia. with the exception of US Title III food aid since 1995 which has been used for emergency relief.

[3] However, some food for work programs in Ethiopia are defined as emergency programs (e.g., Employment Generation Scheme) that is designed to target the neediest able-bodied people.

[4] During the 1984/5 famine camps were set up at which food aid was distributed. Now food aid goes directly to permanent villages.

[5] The exact criteria used to determine "needs" could not be clearly established through liaison with DPPC, and interviews with local officials indicated that the process is to some degree vulnerable to different interpretations of neediness by local officials across weredas.

(generally downward) the number of households determined to be in need and the amount food aid required for each wereda based on historical patterns, the potential supply of food aid to be pledged by donors, and the DPPC's own field-level food insecurity assessments. At this stage an appeal is launched by the Federal Government for food aid, specifying the amount of food and number of households in need for each wereda, zone, and region. However, almost always, the amount of food aid pledged by donors falls short of the requirements as expressed in the appeal, which leads to further downward revision of allocations to weredas.

The second stage begins after the federal DPPC has finalized allocations to each wereda. Wereda Disaster Prevention Preparedness Committees then assign allocations to individual Peasant Associations (there are typically many PAs within a wereda). Then the PA leadership prepares a list of beneficiary households against the assigned allocation. According to the Government's National Policy for Disaster Prevention and Management (TGE, 1993), local-level responsibility for selecting food aid beneficiaries lies with the wereda administration, but implementation is actually carried out by elders and community representatives at the peasant association (PA) level. Neither the DPPC nor NGOs have control over the selection of beneficiaries at the PA level. The critical element of this plan is that while the amount of food to be allocated to each wereda is determined at Federal level (using input from local levels), the actual beneficiaries are designated at the local community (PA) level. Of course, PA leaders are urged to use a set of selection criteria to determine which households are eligible, including livestock ownership, grain production, assets, income, being unable to work because of illness, having no family support network,

and household size (Sharp 1997).[6]

Food For Work (FFW)

Ethiopia's official food aid policy states that no able-bodied person should receive food aid (food for work) without working on a community development project in return. This is complemented by targeted free food aid for those who cannot work. The official goal, as described above, is to expand work-based food aid to the point where it accounts for 80% of all distributions (WFP, 1995). However, household-level data show that, of the total kilocalories of food aid received nationally over a full twelve-month period in 1995/96, only 35% involved work in exchange for the food (Clay, Molla, and Habtewold, 1999).[7]

FFW takes the form of public works programs in historically food deficit or degraded areas. This type of food aid is often referred to as "development food aid." Quite often, completion of planned activities takes precedence over targeting the most

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[6] There is little attempt to self-target food aid, i.e., provide foods that are eaten primarily by the poor, as was the case, for instance, in Mozambique in the early 1990s when food aid consisted largely of yellow maize, a staple of the poor (Tschirley, Donovan and Weber, 1996). In Ethiopia, food aid is predominantly (80 percent) wheat, which is considered a normal good in both rural and urban areas (Kebede, Jayne, and Tadesse, 1996).

[7] There are several reasons why the work in exchange for food is apparently underutilized. First, food aid is sometimes available for distribution to locations considered "in need" without a work project having been identified. Second, anecdotal reports indicate that in situations where the technical input for food for work projects are unavailable, the food aid may be distributed to households with the condition that work will be expected as some point in the future. Lastly, the work requirement for receiving food is sometimes waived if the community is considered weak or stressed as a result of transitory food insecurity.

food insecure households in the allocation of FFW programs. Most FFW activities are planned and resource allocations are committed a year or more in advance — regardless of current crop assessment conditions.[8] Because most FFW programs are planned far in advance and for multi-year periods, one might expect that FFW should exhibit less income-based targeting than free distribution programs, at least with regard to which weredas get targeted.

Rules determining participation in FFW programs have varied widely (Sharp, 1997). In some cases self-targeting has been used, by which households decide whether to send members to work at the offered food wage. Typically a given project pays a constant daily food wage, not differentiating by the human capital of workers (DPPC, 1997). In the past, offered wages have typically been higher than local market wages (Webb, von Braun, Yohannes, 1992; Sharp 1997), which should result in much less income targeting than in a low wage regime. Ration amounts are based on daily nutritional requirements of a cereal-based diet for an average family of six persons. Also, on some food for work projects, beneficiaries are paid an additional amount of food aid as an allowance for transport when the project area is at a significant distance from where they live (REST projects in Tigray, for example).

Providing in-kind wages higher than local wage rates for manual labor is often justified by the contention that poverty is endemic in many rural areas, so that targeting is implicitly not needed, plus a concern that a "livable" wage be paid (DPPC, 1997).

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[8] An exception is "Employment Generation Schemes," mechanisms for distributing emergency relief that require participation in public works and tend to expand or contract based on needs and availability of relief resources.

However, programs in other areas have targeted FFW opportunities more narrowly to specific types of households. In these schemes, a local community group chooses households who will be eligible for participation based on some underlying criteria, which may be easily measured or not. In some cases there is *de jure* rationing of either spaces (restricting the number of eligible participants per household) or time allowed per person. Other factors that are claimed to be used to target households now are poverty, livestock and other asset ownership, crop production and size of landholding (Sharp, 1997).

2.3.2. Food Aid Payments in-Kind

Both FD and FFW are paid in cereals and cooking oil. Table 2.2 shows average amount (kilograms and liter) and values (birr) of cereals and cooking oil received among households who received FD and participated in FFW. We used regional prices of cereals and cooking oil to convert quantities into values. Among households who received FD, a typical household received 83 kilograms of cereals and 5 liters of cooking oil. This is less than half of what households received on average, 180 kilograms, during the worst famine year between 1982 and 1988 according to Webb, et al. (pp106, 1992). Out of 83 kilograms of cereals received, wheat consists 66 percent of total quantity of cereals received, while maize and sorghum consist 7 and 21 percent respectively.

In FFW, maize was used more as in-kind payments. Among households who participated in FFW, a typical household received 51 kilograms of wheat, 17 kilograms of maize, and 22 kilograms of sorghum; the total is 90 kilograms of cereals. Wheat consists

Table 2.2. Food Aid Payments in-Kind

	Free Distributions (FD) in				Food For Work (FFW) in			
	wheat	maize	sorghum	cooking oil	wheat	maize	sorghum	cooking oil
	—	kgs (%)[2] —		– liter –	—	kgs (%)[2] —		– liter –
Quantity[1]	55	7	21	5	51	17	22	9
	(66)	(8)	(26)		(57)	(19)	(24)	
	—	birr (%)[4] [%][5]	—		—	birr (%)[4] [%][5]	—	
Value[3]	90	6	23	50	81	15	23	30
	(76)	(5)	(20)		(68)	(13)	(19)	
	[53]	[4]	[14]	[30]	[54]	[10]	[16]	[20]

Note: 1) Mean kgs of cereals and cooking oil received among households who received food aid. 2) Percentages out of total kgs of cereals, 83 kgs (FD) and 90 kgs (FFW). 3) Mean values (birr) received among households who received food aid. 4) Percentages out of total values of cereals received, 119 birr (FD) and 119 birr (FFW). 5) Percentages out of total values received including cooking oil, 169 birr (FD) and 129 birr (FFW).

57 percent of total quantity of cereals received, while maize and sorghum consist 17 and 22 percent of the total respectively. Sharp (1997) reports that the standard food wage of "3 kilograms of wheat and 120 grams of oil per day" was widely used in 1996, which indicate that this standard rate has been used over a decade because Webb, et al. (1992) indicate that this same rate was used during early 1980's.

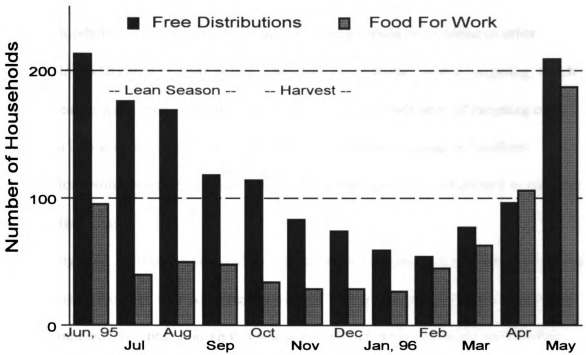
Wheat and cooking oil are more valuable than maize and sorghum. Among households who received FD, a typical household received 90 birr of wheat, 6 birr of maize, 23 birr of sorghum, and 50 birr of cooking oil. Wheat consists 76 percent of the total value of cereals and 53 percent of total value of FD including cooking oil. Among households who participated in FFW, a typical household received 81 birr of wheat, 15 birr of maize, 23 birr of sorghum, and 30 birr of cooking oil. Wheat consists 68 percent of total value of cereals and 54 percent of total values received from FFW.

2.3.3. Seasonality

The major harvest season, Meher, starts around October and finishes around December. Figure 2 shows that food aid distributions are sensitive to agricultural season. The number of households who received FD reaches its bottom after the major harvest season in January and increases as the lean season approaches. The lean season in rural Ethiopia is considered between July and September.

The seasonality of FFW depends on agricultural season and rainy season. FFW projects try to attract participants during non-busy season so that participants do not need to reduce working time on farm. Yet, FFW projects often need to finish its projects before the rainy season (July and August), which may be a major reason that the number of households participated in FFW reaches its highest in May (May is a part of planting season). This is often a dilemma for participants. Poor households who need to obtain food for current consumption have incentives to participate in FFW during a planting and growing season. However, by doing so they will have less output around the harvest season. As a result, only households with excess labor participate in FFW, who are usually richer than others (Sharp, 1997).

Figure 2.2. Food Aid Seasonality



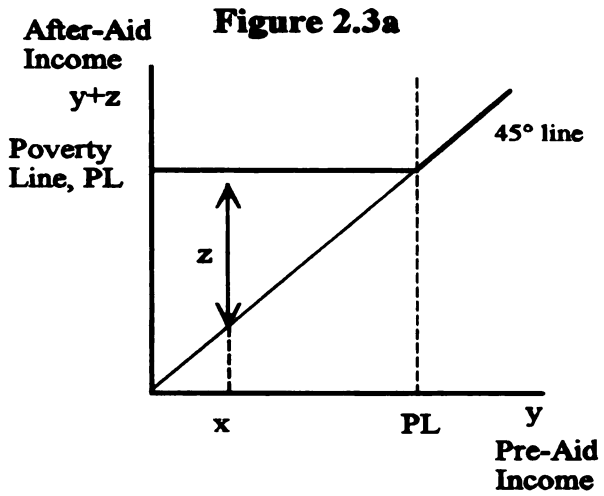
2.4. Targeting

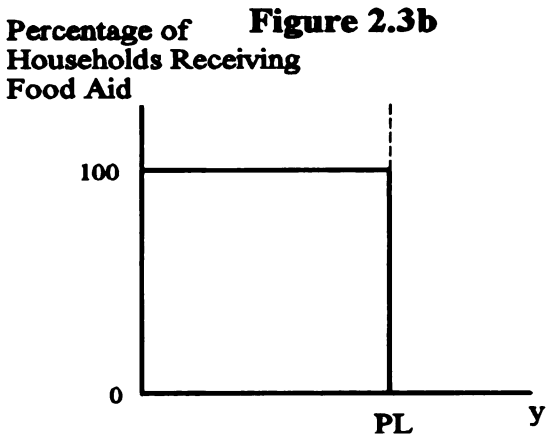
2.4.1. Complete vs. Optimal Targeting

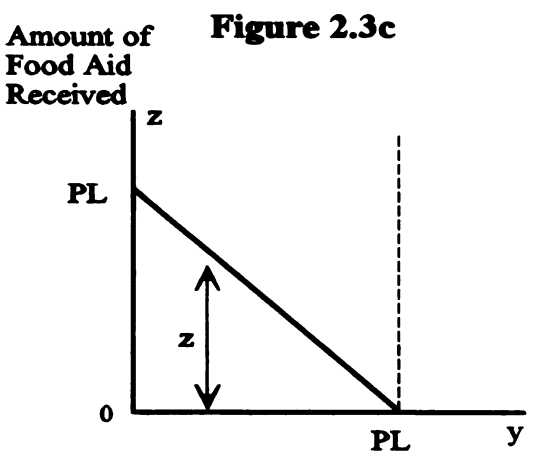
Figure 2.3 described *complete targeting* (Besley and Kanbur, 1993). Note however that complete targeting may not be a cost effective targeting. Identifying poor or needy households requires costs in practice. Such costs could be provided to other households, who could be poor or rich. Therefore the "optimal" level of targeting, which maximizes the welfare level and the size of recipient households after all targeting costs are taken into account, can be found between the complete targeting and uniform distribution. Nonetheless, examining complete targeting gives us a benchmark to consider a better targeting.

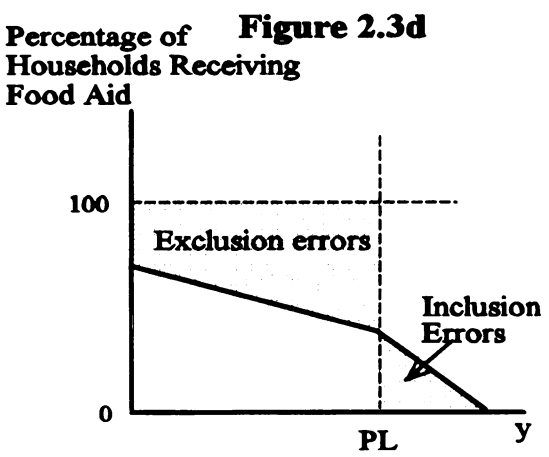
Figure 2.3a plots households' pre-aid income levels (on the horizontal axis) against their adjusted incomes after counting the value of food aid received (on the vertical axis). Under complete targeting, households whose pre-aid income is below the poverty-line threshold (PL) receive aid such that their after-aid income is brought up exactly to the poverty line. For example, a household whose pre-aid income level is at point x would receive food aid worth z in order to bring that household's income up to the poverty line income. The shaded area represents the value of food aid transferred to vulnerable households. Households whose pre-aid income is greater than the poverty line receive no food aid. We might expect to see results similar to that displayed in Figure 2.3a only under the highly unrealistic conditions that (1) food aid authorities have perfect information on who are the vulnerable and the extent of their vulnerability; (2) there are no fixed costs in the organization and

Figure 2.3. Complete and Incomplete Targeting









implementation of food aid programs; (3) government's only objective in food aid programs is to minimize the number of vulnerable households; and (4) food aid resources are sufficient to meet the needs of all households below the threshold poverty line.

This "complete" situation in Figure 3a would produce results shown in Figure 2.3b (which shows the bivariate relationship between income and the probability of receiving food aid) and Figure 2.3c (which shows the bivariate relationship between income and the amount of food aid received). Under the complete targeting assumptions stated above, the probability of receiving food aid would be 100% for all households below the poverty line (PL) and zero for households above it. The relationship between household income and amount of food aid received under the complete targeting would confirm to Figure 2.3c, in which the value of food transferred were just sufficient to restore the recipient's adjusted income to the poverty line. Households with pre-aid income greater than PL would receive nothing.

There is little expectation that food aid targeting in practice should conform to the patterns reflected in Figures 2.3a-c. Collecting information both at region level and household level is costly. And to the extent that there are fixed costs in the operation of food aid programs, the correlation between the household vulnerability and receipt of aid should decline, certainly at national level and most likely within weredas as well. And there may be other objectives in food aid transfers in addition to minimizing poverty.

Now consider Figure 2.3d, which is similar to Figure 2.3b but shows an "incomplete" degree of income targeting. The probability of receiving aid is still negatively related to income, but not all households below the poverty line receive aid, a

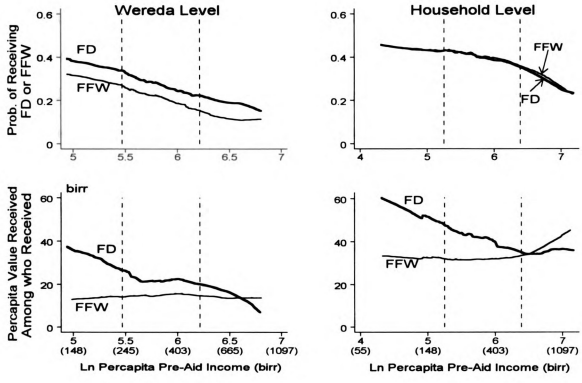
case commonly referred to as a *targeting error of exclusion* (see Jaspers and Young 1995). Moreover, some households above the poverty line do receive food aid, representing *targeting errors of inclusion.*

2.4.2. Actual Targeting

The top two panel graphs of Figure 2.4 show how the probability of receiving food aid vary with the log of per capita income, while the bottom two panels show how per capita amounts received (conditional on positive receipt) vary with the log-per capita income. The left-hand panels graph the relationships at the wereda-level and the right-hand panels for households. The household-level graphs are conditioned on living in weredas that have some sample households that receive food aid. One can see that wereda participation rates are declining in wereda mean log-per capita income for both FD and FFW, with the free distribution receipt probabilities being higher than those for food for work by just over 5 percent, across the distribution of mean incomes. Per capita amounts received are also inversely related to wereda mean log-per capita income for free distribution, but are constant for food for work.

At the household-level, the FD and FFW participation curves are almost identical. They display a gentle negative slope until a log-per capita income of around 6, corresponding to just under the the 60th percentile, but then participation drops off much more steeply for households with higher log per capita incomes. The amounts received per capita by households fall off with log per capita income for free distribution, but not for food for work. Figure 2.4 strongly

Figure 2.4. Free Distribution and Food For Work by Ln Per capita Income



Note: Dotted lines are drawn at the 25th and 75th percentiles of ln per capita pre-aid income, corresponding to 284 and 623 birr for weredas, and 190 and 595 birr for households.

suggests that the probability of receiving food aid is linearly related to our log-per capita income measure at the wereda level.

2.5. Conclusions

In this chapter, I presented some background information on food aid distribution in rural Ethiopia. According to households survey data in 1996, we found that households who lived in areas where the 1984/85 famine had hit the hardest still received high level of food aid in 1996. Food aid has been distributed through two major schemes, free distribution (FD) and food for work (FFW). Wheat has been used as a major food aid cereal in both FD and FFW. The food aid distribution showed a seasonality according to agricultural seasonality. High proportion of food aid was provided to households before and during a lean season (Figure 2.2). Finally, bivariate relationships between food aid distribution and pre-aid per capita income showed negative relationships, which indicate that some targeting was done and poor households had higher probability of receiving food aid through FD and FFW. Based on the information presented in this chapter, we will examine how food aid affects child labor supply and crop marketings in following chapters.

Chapter 3

FOOD AID, HOUSEHOLD COMPOSITION, AND CHILD FARM LABOR SUPPLY IN RURAL ETHIOPIA

Abstract

This chapter determines effects of household demographic composition and food aid on child farm labor supply controlling for household fixed effects. The results indicate that a child, especially a boy, has higher probability of working on farm if he or she is living with younger children, suggesting that older children living with younger children are reducing resource constraints by working on farm. Other household demographic compositions also have significant effects on the probabilities of children working on farm. The results on food aid indicate also that receiving free distribution has *relatively* larger positive effects on the probability of girls working on farm than boys, while participating in food for work has *relatively* larger positive effects on the probability of boys working on farm than girls.

3.1. Introduction

Children work hard in developing counties. Recent empirical studies on child labor in developing countries reinforced this statement repeatedly (Cain, 1977; Grootaert and Kanbur, 1995; Basu, 1999; Grootaert and Patrios, 1999). Children in rural Ethiopia are typical in facing a trade-off between working and schooling. Rural households cited work requirements — farm work for boys and household work for girls — as the single most

important reason for not sending their children to school (the World Bank, 1998).

Although there is an increasing number of studies on child labor, many empirical studies come from South Asia, where farm labor markets are active, and show that children are economically active and responsive to wage rates (Rosenzweig and Evenson, 1977; Cain, 1977; Skoufias, 1993; Jacoby and Skoufias, 1997). In rural Ethiopia, farm labor markets are not as much active as in South Asia, as we show later in this chapter, and children work on farms as unpaid family workers with very few hired workers.[9] Under such conditions, the household composition becomes an important factor in child farm labor supply. Yet, the direction of effects of having one more child in the household on other children's labor supply is not clear. Having one more child may reduce other children's work share but may increase their work burdens because of additional expenditure. In Taiwan, for instance, Parish and Willis (1993) argue that older sisters reduce resource burdens for their younger siblings by both marrying away and working early. In Ghana, Garg and Morduch (1998) find that if children had all sisters (and no brothers) they would do roughly 25-40% better on measurements of health indicators than if they had all brothers (and no sisters). However, the child composition may not be exogenous; households may have some control over the child composition through fertility (Schultz, 1997), fostering (Ainsworth, 1996), adoption, marriage (Parish and Willils, 1993), migration, or other arrangements.

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[9] In Ghana, Canagarajah and Coulombe (1999) show that more than 90 percent of children in their sample were involved in household level agriculture activities. Other studies from Sub-Saharan Africa also show a large number of children working on family farm as unpaid family workers (Bekombo, 1981; Bonnet, 1993; Grootaert, 1999; and Akabayashi and Psacharopoulos, 1999).

Food aid in rural Ethiopia provides an opportunity to examine how various policies influence child farm labor supply. Food aid was thought to discourage farm labor supply on farm production by providing food directly to households and by providing employment opportunities outside farm production (Webb, von Braun, and Yohannes, 1992; Webb and von Braun, 1994; Maxwell, Belshaw, and Lirenso, 1994; Datt and Ravallion, 1994; on food subsidies, Sahn and Alderman, 1996). On the other hand, food aid may increase labor supply of recipients by increasing their health status. The sizes of both disincentive and positive effects of food aid may differ between girls and boys, or young and old. Recent studies on intrahousehold resource allocation call attention to how resources are allocated within the household (Haddad, Hoddinott, and Alderman, 1997; Strauss and Beegle, 1996). When food aid is provided to the neediest households or the neediest individuals within the households, the positive effects of food aid on labor supply may exceed the disincentive effects. Therefore, it is an empirical question how food aid affect recipients' farm labor supply.

The purpose of this chapter is to determine the effects of household composition and the *differential* effects of food aid on child farm labor supply. First, we estimate "reduced form" farm labor supply for children with ordered logits. Children aged 7 to 14[10] were stratified into four groups: boys aged 7 to 10, girls aged 7 to 10, boys aged 11 to 14,

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[10] We include all children aged between 7 and 14 in our sample, instead of restricting the sample to household heads' biological children. About 15 percent of all children are step children (almost all of them are heads' biological children with step mothers), and another 15 percent are not children of the heads but younger brothers or sisters of heads, relatives, or non-relatives. Because we include all of them in our analysis, we avoid using *siblings* to indicate children living in the same household.

and girls aged 11 to 14. Second, we compare the effects of household composition without controlling for household fixed effects (logits) and with controlling for household fixed effects (conditional logits) because the estimated coefficients of household composition without controlling for household fixed effects might be biased if household composition is correlated with unobservable household characteristics. Third, we estimate *differential* effects of food aid on child farm labor supply between boys and girls, boys and female adults, and girls and female adults with controlling for household fixed effects. Female adults were included for comparison. Male adults were excluded because information on male adults' farm labor supply has little variation.

The results from reduced form child farm labor supply models with controlling for household fixed effects indicate that a child, especially a boy, has higher probability of working on farm if he or she is living with younger children,[11] suggesting that older children living with younger children are reducing resource constraints. Other results from reduced form models without controlling for household fixed effects indicate that having household heads with some education and having more male adults in the same household significantly decrease the probabilities of boys and girls in the older age category (aged 11 to 14) working on farm, but not the probabilities of boys and girls in the younger age category (aged 7 to10). The results also indicate that having more female adults increases the probability of girls in the older age category working on farm, which may suggest that girls have lower productivity in home production when more female adults are available in

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[11] "Older" and "younger" are based on relationships between a child and other children living in the same household.

the households. On food aid's effects, the results indicate that food aid has significantly different effects between boys and girls.

The rest of this chapter is organized as follows: Section 3.2 describes the data we use and gives a brief description of farm labor supply and food aid distributions in rural Ethiopia. Section 3.3 provides theoretical models and empirical specification. The results and interpretations are in Section 3.4, followed by Section 3.5 with conclusions.

3.2. Data

The data come from the 1996 Food Security Survey (FSS), fielded on a subset of Agricultural Sample Survey (ASS) sample households in 1996 by the Central Statistics Authorities (CSA) and the Grain Marketing Research Project in Ethiopia. In ASS sample, 25 households were randomly selected in each Enumeration Area (EA); there were 612 EAs in the sample. Out of the 25 sampled households in each EA, 12 households were selected to be in the Economic and Social Welfare Monitoring Survey (ESWMS) funded by the World Bank. The ESWMS asked distances to various infrastructure such as primary schools, health center, water source. Out of the 12 households in each EA, 7 households were selected to be in the Food Security Survey (FSS), leaving 3,823 households.[12] In addition, monthly rainfall data were taken from 40 rainfall stations distributed throughout Ethiopia and matched to the locations of the household samples.

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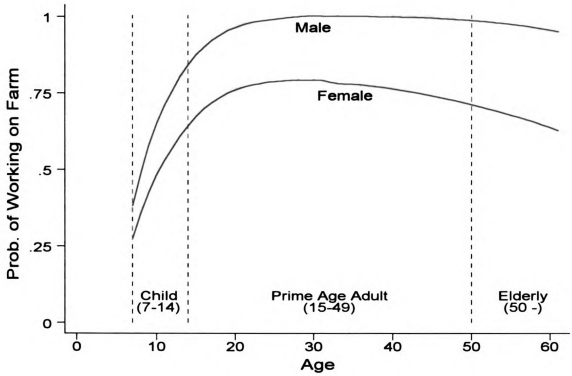
[12] Actually, out of the FSS households, 126 are *not* in the ASS sample, for reasons that are not documented. They are more likely to be female headed, with half the land owned and a much greater likelihood of receiving food aid compared to the 3823 households in both FSS and ASS.

Figure 3.1. Probability of Working on Farm by Sex



The Food Security Survey collected detailed information regarding amounts of food aid received by each household, plus other individual and household level information such as farm labor supply, household demographics, farm production.

Farm Labor Supply

The FSS asked each household member's farm labor participation in own farm production in three categories: working full time, half time, and no/little time. In Figure

Table 3.1. Sampled Households, Food Aid, and Hired Agricultural Labor

Region	Number of Sampled Households	Households who hired agricultural labor [1]	Food Aid	
			Households Received Free Distribution (FD)	Households Received Food For Work (FFW)
	Number	— Percent of Households —		
Tigray	229	8	40	34
Amhara	1043	9	25	11
Oromiya	1343	12	5	7
South	973	8	8	7
Addis Ababa / Dire Dawa	125	24	6	32
Others	368	7	15	8
Total	4081	10	14	10

Note: 1) During Meher season in 1996.

3.1, we plot the age profile: the bivariate relationship between the probability of working more than half time and age for male and female separately.[13] At age 7, already more than 30 percent of boys and about 25 percent of girls work more than half time on farm. And the probability of working rapidly increases in early ages. By age 14, more than 75 percent of boys and about 60 percent of girls work more than half time on farm. For male, the probability continues to increase, and by age 25 almost all male adults work more than half

[13] Figure 1 and 2 are created using locally weighted smoothed scatter plot (LOWESS) with window length set at .6 or .7 of the neighboring observations. The smoothed values are obtained by running a regression of y-variable on x-variable using weighted data so that the central point gets the highest weight and points farther away receive less weights. The estimated regression is then used to predict the smoothed value for y-variable. The procedure is repeated to obtain the remaining smoothed values, which means a separate weighted regression is estimated for every point in the data. We truncated the graph at the top 5 percent of age because the shape of the line is sensitive to the small number of observations.

time on farm. The male's probability starts declining at age 50. For female, the probability reaches its peak, about 75 percent, around age 30, and starts declining gradually.

Farm labor markets are not active in rural Ethiopia. In Table 3.1, we present percentages of sampled households who hired agricultural labor during the major cropping season (Meher) in 1996. Only 10 percent of households hired agricultural labor on average. (The percentage of households who worked as hired agricultural labor should be higher than 10 percent. Unfortunately we do not have information on working as hired agricultural labor.) The percentages of hiring agricultural labor are relatively lower in major food aid reception regions, namely Tigray and Amhara, than other regions. Although this information is very limited, but it is a solid indication of thin farm labor markets in rural Ethiopia

Food Aid

Food aid in Ethiopia has historically taken two major forms (Webb, von Braun, and Yohannes, 1992; Webb and von Braun, 1994): free distribution (FD) and food for work (FFW). FD programs distribute cereals (wheat, maize, and sorghum) and cooking oil directly to households. On FD distribution, after the federal-level Disaster Prevention and Preparedness Commission (DPPC) decides which weredas[14] to send free food, elders and community representatives at the peasant association (PA) take responsibility of distributing free food to needy households within a wereda. Although local level

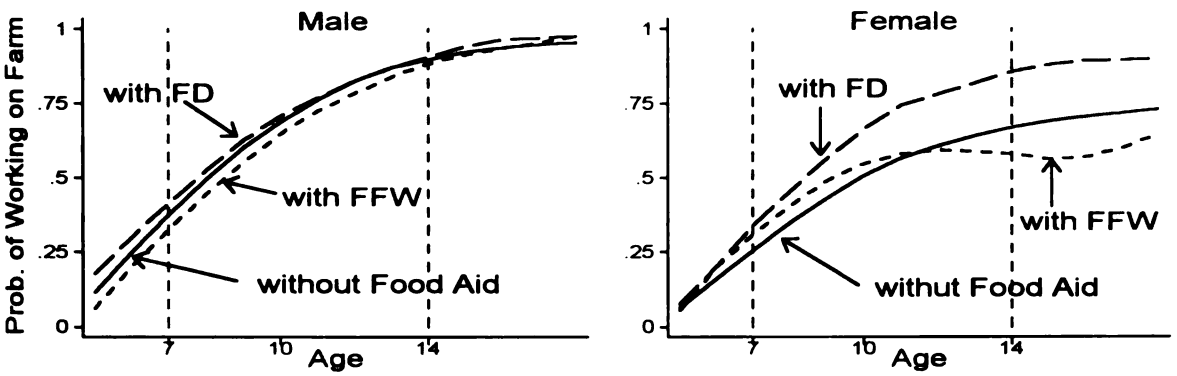
[14] Wereda is a small regional unit, which is akin to county in the United State. There are about 450 weredas in rural Ethiopia and 348 weredas in our sample.

distribution criteria varies from one wereda to the others (Sharp 1997), some level of targeting to low income households was achieved (Jayne, Strauss, Yamano, and Molla, 2000).

Most FFW activities are categorized as "development" food aid programs since they focus on developing assets such as roads, terraces, and dams. In theory, FFW is supposed to attract workers from low income households through self-selection (Besley and Kanbur, 1993). But in practice, payments from FFW were often set above local wage rates, attracting participants from all income levels (Sharp, 1997). Moreover, it is not clear how effectively self-selection functions in areas with thin farm labor markets. Nonetheless, Jayne, Strauss, Yamano, and Molla (2000) found a negative association between FFW participation and per capita pre-aid income; although, the association was smaller and weaker than the one found in FD programs.

Receipt of food aid is measured for each household in the Food Security Survey. For the last 12 months, the respondent is asked whether at least one member of the household participated in a food aid program. If yes, the type of program (as reported by the household) is recorded, separating FD from FFW, and by type of commodity received. If food aid was received, the quantities received were recorded for each month from June 1995 through May 1996. Unfortunately, we do not know which member of a given household participated in FFW. This is a serious data limitation for us because participating in FFW may reduce participants' working time on farm significantly but may increase nonparticipants' working time to substitute in for participants.

Figure 3.2. Probability of Working on Farm with Food Aid



Food Aid's Effects: Non-parametric Analysis

In Figure 3.2, separately for male and female, we stratified our sample into three groups: children without any food aid, children with FD, and children with FFW.[15] The figures represent just bivariate relationships between the probability of working on farm and age for three groups. Thus the differences between the lines should not be considered as causal effects of food aid on the probability of working on farm. As one can see in the left panel of Figure 3.2, we do not see much differences in probability of working on farm between these three groups of boys. But for girls, the differences are more obvious. Girls with FD have a higher probability of working on farm than girls without any food aid.

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[15] We do not include children with both FD and FFW in Figure 2

Girls with FFW have much different age profile. Girls with FFW have a lower probability of working on farm than girls without any food aid if they are older than twelve. One possibility, out of many other possibilities, is that girls aged above 12 participate in FFW by reducing their working time on farm. However, because we do not have individual level information of FFW participation, we are unable to investigate it further.

3.3. Food Aid Effects

3.3.1. Theoretical Models

The household utility function is assumed as a function of total household consumption (C), adults' leisure (l_a), and children's leisure (l_c): $U(C, l_a, l_c : \alpha)$, where α is household characteristics, including household composition. The budget constraint is

$$C = F(L^F_a+L^H_a, L^F_c+L^H_c; A) - w_aL^H_a - w_cL^H_c + w_aL^O_a + w_cL^O_c + Z \qquad (3.1)$$

$$L^T_a = L^F_a + L^O_a + l_a \qquad \text{for adults}$$

$$L^T_c = L^F_c + L^O_c + l_c \qquad \text{for children}$$

$F(.)$ is the strictly concave farm production function; L^F_a and L^F_c are adults' and children's labor time spent in farm production, respectively; A is exogenous farm production characteristics; L^H_a and L^H_c are hired adult and child labor; L^O_a and L^O_c are adults' and children's off- farm labor time; w_a and w_c are wage rates for adult and child labor; Z is non-labor income; and L^T_a and L^T_c are adults' and children's total labor time.

In following analysis we will focus our attention on child *farm* labor supply under various situations. The effect of free distribution (FD) is considered as an increase in non-labor income (the income effect) while the effect of food for work is considered as an

increase in adult labor's wage (the substitution effect) because adults participate in FFW in most cases. Because child labor markets are often absent in rural Ethiopia, we will consider a situation where children do not have access to labor markets (a non-separable case).

If the model is separable between production and consumption decisions, the *total* child labor supply (L_c) is a function of wages and the full income (M): $L_c = L^T_c - l(w_a, w_c, M; \alpha)$. However, the child *farm* labor supply depends on different factors depending on whether a household is a net child labor seller or buyer. If a household is a net child labor seller ($L^O_c>0$), then the child farm labor supply is determined at where the marginal production is equal to the child wage rate. Therefore the child farm labor supply is $L^F_c = L^F_c(w_a, w_c, A)$, which is not a function of the full income or household composition. The impact of an increase in the child wage rate is negative, but the impact of the adult wage rate is positive under assumptions of $F''_{LcLa}<0$ and $F''_{LaLc}<0$.[16] On the other hand, if a household is a net child labor buyer, then the child farm labor supply is determined at where the marginal rate of substitution between consumption and child leisure is equal to the child wage rate; $L^F_c = L^F_c(w_a, w_c, M; \alpha)$. The impact of an increase in the full income is negative.

The effects of household composition and of food aid when a household is net child labor seller are different from the effects when a household is net child labor buyer. Household composition and free distribution (FD) and have *no effects* on child farm labor

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[16] From profit maximization with respect to two labor inputs, we have $F'_{La}(L_a, L_c)= w_a$ and $F'_{Lc}(L_a, L_c) = w_c$. The total differentiation and some arrangements give us: $dLc/ dw_a = 1/(F''_{LaLa}F''_{LcLc} -F''_{LaLc}F''_{LcLa})(-F''_{LcLa}) >0$.

supply when a household is net child labor seller (even though they have impacts on the total child labor supply). When a household is net child labor buyer, FD has negative impacts on the child farm labor supply, while household composition can have impacts in either direction. FFW (increases in adult labor wage rates) increases the full income, so it has negative income effects when a household is a net child labor buyer, but has no income effects on child farm labor supply when a household is net child labor seller. However, increases in adult wages do have substitution effects on child labor demand; adult labor becomes more expensive so the demand for child labor increases. As a result, FFW has positive effects on child farm labor supply of net child labor sellers but a mix of positive and negative effects on child farm labor supply of net child labor buyers.

When child labor markets do not exist (a non-separable case), the child farm labor supply is a function of the adult wage rate, shadow wages for child farm labor, which is a function of full income based on shadow wages and household characteristics: $L^F_c(w_a, w_c^*, A)$. An increase in non-labor income increases the child shadow wage by shifting up the supply of child labor conditional on shadow wages and full income. Thus has negative effects on child farm labor supply. An increase in the adult wage rate increases the shadow wage of child farm labor by shifting up child labor demand and supply. Therefore the direction of FFW's effects is ambiguous because an increase in adult wage has positive effects but also has negative effects through increases in full income and the shadow wage

Table 3.2. The Effects of Food Aid on Child *Farm* Labor Supply

	Separable		Non-Separable (No child labor market)
	Net Seller	Net Buyer	All
FD ($\Delta Z>0$)	No Effects	Negative Effects	Negative Effects
FFW ($\Delta w_a>0$)	Positive Effects	Ambiguous	Ambiguous

of child farm labor. Based on these results, we will examine the differential effects of FD and FFW. Before we estimate models, we present our estimation strategies in the next sub-section.

3.3.2. Empirical Specification

As mentioned previously, we do not observe farm labor allocation time itself in our survey data, rather we observe categorical information: full time(2), half time(1), and no/little time(0) working on farm production. The linearized version of the reduced form farm labor supply using a categorical dependent variable can be written as:

$$\begin{aligned} y_{ij} = \quad & 0 \quad \text{if} \quad z_1 > y^*_{ij} \\ & 1 \quad \text{if} \quad z_2 > y^*_{ij} > z_1 \\ & 2 \quad \text{if} \quad y^*_{ij} > z_2 \end{aligned} \tag{3.2}$$

where $y^*_{ij} = \beta_x' x_{ij} + \beta_h' h_j + e_{ij}$.

y_{ij} is individual i's farm labor supply in household j; y^*_{ij} is the latent variable of y_{ij}; x_{ij} is individual characteristics; and h_j is household characteristics; z_1 and z_2 are cut-points that to be estimated; and β_x' and β_h' are coefficients. We estimate the reduced form child farm labor supply equations with ordered logit.

Conditional Logits[17]

Next, we estimate the differential effects of food aid using the conditional logits models, developed by Chamberlain (1980). Let us illustrate the conditional logits when N=2, and then demonstrate how this model can be applied in our models. Let the logits model be:

$$\text{Prob}(y_{ij} = 0 \mid x_i, \alpha_j) = 1 / (1 + \exp(\beta'_x x_i + \alpha_j)) \qquad \text{for i = 1, 2} \qquad (3.3)$$

$$\text{Prob}(y_{ij} = 1 \mid x_i, \alpha_j) = \exp(\beta'_x x_i + \alpha_j) / (1 + \exp(\beta'_x x_i + \alpha_j)) \quad \text{for i = 1, 2} \qquad (3.4)$$

where α_j is the household characterisitcs. Only relevant case is when $\tau_i = y_{1j} + y_{2j} = 1$. Therefore the conditional probability, conditioning on $\tau_i = 1$, is

$$\begin{aligned} \text{Prob}[(1,0)|(1,0) \text{ or } (0,1)] &= \text{Prob}(1,0) / [\text{Prob}(1,0)+\text{Prob}(0,1)] \\ &= \exp(\beta'_x x_1 + \alpha_j) / [\exp(\beta'_x x_1 + \alpha_j) + \exp(\beta'_x x_2 + \alpha_j)] \\ &= 1 / [1 + \exp(\beta'_x (x_2 - x_1)] \end{aligned} \qquad (3.5)$$

The household characteristics, α_j, has been conditioned out.

Now let us consider our problem with an example of a two-person household with one boy and one girl. First, we need to redefine our dependent variable into a dummy variable. We redefine y_{ij} equal to one if the individual i works more than half time, and

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[17] The discussion in this sub-section follows Pitt (1997).

zero otherwise:

$$y_{ij} = \begin{cases} 0 & \text{if } z_1 > y^*_{ij} \\ 1 & \text{if } y^*_{ij} > z_1 \end{cases} \quad \text{for } i = \underline{\text{b}}\text{oy or } \underline{\text{g}}\text{irl} \qquad (3.6)$$

where $y^*_{ij} = (\beta_z + \delta_z d_i)' q_j + (\beta_x + \delta_x d_i)' x_{ij} + (\beta_h + \delta_h d_i)' h_j + \alpha_j + u_{ij}$.

q_j is the per capita value of food aid received at the household level; d_i is the gender dummy variable which is one if individual i is a girl; h_j is observable household characteristics; δ's are the coefficients of the interaction terms with gender dummies; the error term e_{ij} is decomposed into two components: α_j is a household specific components (the unobservable household characteristics) and u_{ij} is an individual specific component; and other variables are as defined in (3.2).

Because food aid is not distributed randomly, the per capita value of food aid received, q_j, is more likely to be endogenous or to be correlated with the unobservable household characteristics, α_j. As a result, estimated coefficients of q_j may be biased. Moreover, some of other variables, such as household composition, might be correlated with α_j also. By taking a difference between the farm labor supply of a boy and girl in household j, y^*_{bj} and y^*_{gj}, we have

$$y^*_{bj} - y^*_{gj} = \delta_z d_b' q_j + \beta_x'(x_{bj} - x_{gj}) + \delta_x d_b' x_{bj} + \delta_h d_b' h_j + (u_{bj} - u_{gj}). \qquad (3.7)$$

The unobserved household characteristics is eliminated, and so q_j is no longer correlated with the error term, provided that α_j was the source of the correlation. However, we are no longer able to estimate β_z and β_h. We can estimate this equation with conditional logits; the right hand side of this equation except the error terms is the $\beta'_x (x_2 - x_1)$ in the equation (3.5).

If food aid, q_j, is correlated with the unobservable household characteristics, α_j, but not with the error terms in conditional logits, then estimators of δ_z is consistent. However, if the food aid, q_j, is correlated with the error terms of conditional logits, i.e., $cov(q_j, u_{bj} - u_{gj}) \neq 0$, then the estimators of δ_z will be biased. A possible candidate of an important unobservable individual characteristics is child health status. It is reported that child health status was used often as a targeting measure in free distribution (Sharp 1997). To avoid this potential omitted variable problems, it is possible to use an instrumental variables approach by using restrictions that set some of δ_h's equal to zero to obtain instruments as in following Pitt and Rosenzweig (1990). But because such restrictions require a very strong assumption, we do not take this approach, leaving the possible biases in the equation (3.7) unexamined.

3.3.3. Variable Construction

As discussed in section II, we use categorical information on farm labor supply as our dependent variables. The food aid variables are constructed as the per capita value received by each household. Because food aid is paid in kind (wheat, maize, sorghum, and cooking oil), regional level prices were used to convert kilograms-received into value-received in birr. Other variables used in our estimations are as follow.

Individual Characteristics

Unfortunately, we do not have much individual information, only age and the

relationship with household head.[18] We use this information to measure children's status in their household, and to categorize each child into three groups. The first group is children whose biological parents are the head of the household and his wife. The second group is children who have a step-father or -mother. A child in this group is called *step child.* Almost all step children are children of household heads. The last group is children who are either brothers or sisters of the heads, other relatives, or non-relatives. A child in this group is called *relative child* even though this group includes children who are not relatives of household heads. A household with higher labor demand both in farm and home production may have incentives to adopt or foster children to fulfil their labor demand. By using data from Cote d'Ivoire, Ainsworth (1996) studied the determinants of fostering and showed that a child labor explanation was consistent with the determinants. Thus if fulfilling labor demand is a major reason of keeping *relative children,* then we may find *relative children* working more than other children. In estimation models, we use two dummy variables for the last two groups: *step child* and *relative child.*

Child Composition

We include six variables on child composition; four of them are *child specific,* which means that each child within a household has distinct values in the four variables. The four variables are number of younger boys, younger girls, older boys, and older girls in aged between 7 and 14. Younger and older are defined based on a child in question. For

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[18] Entire categories are head, wife/husband, head & wife's child, head's child (but not wife's), wife's child (but not head's), head's or wife's father or mother, head's or wife's sister or brother, others, and no relation.

instance, for a 7 year-old boy who has a 10 year-old sister, the number of older sister is one. And for the sister, the number of younger boys is one. Therefore they have different values in two variables even though they belong to the same household. The other two child composition variables out of six, are the number of boys and girls under age 6. For children aged between 7 and 14 who belong to the same household, the number of boys and girls aged under 6 are the same. Thus, these two variables are *household specific* variables. This distinction is important when we estimate conditional logits, because we can estimate level effects for child specific variables, while for household specific variables we can not.

Other Demographic Composition

We also include four other demographic composition variables. The four variables are the number of male and female adults aged between 15 and 49, and male and female elderly aged over 50. Again for children aged between 7 and 14, these variables are household specific.

Household Characteristics

The only information on education is of the household head.[19] Since most of household heads did not have education, we use a dummy variable which is one if the household head had any education. We also include two dummy variables for female

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[19] Therefore we can not test whether husband's and wife's education have different effects child labor supply, as in many intra-household studies. See Strauss and Beegle (1996) for survey.

headed households, one for a female head who is currently unmarried, and one for currently married female heads. We have three variables that represent household wealth, the amount of land owned in hectares, the value of large animals owned in birr, and value of chicken owned in birr. Large animals and chickens are separated, because the former are likely to be herded by children. The predominant religion in Ethiopia is Orthodox Christianity, but there are a substantial number of Muslim and Protestant households as well. Therefore we use two dummy variables; one for Muslim households and one for Protestant households. Other religions such as local or traditional religions are omitted with Orthodox Church. The last household characteristic variable included is a dummy variable for households engaging exclusively in livestock production (herders), because their production system is significantly different from farm production systems.

Regional Level Characteristics

We have wereda[20] average distances to the nearest primary school, which comes from the Social Welfare Monitoring Survey. In that survey, each household was asked its distance to the nearest primary school in kilometer. Because the survey covers the same weredas in the FSS survey we were able to match the wereda average distance to the nearest primary school to the FSS sample households at wereda level. From the Social Monitoring Survey we have similar information on distances to the nearest health center and water source, which we also include.

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[20] Wereda is a small local administrative unit, which akin to county in the United States. There were about 450 weredas in rural Ethiopia and 348 weredas in our sample.

Regarding agro-climate variables, we have elevation (in meters) and long-run rainfall during a growing season. Elevation readings were taken using the Global Positioning System, a satellite-based system designed to take such readings. Rainfall is a critical factor related to cereal production in Ethiopia because farming is rainfed (not irrigated). We use median Meher season planting rainfall (in millimeters) from 1988 through 1995.[21] These were derived by summing April through August rainfalls for these years from data collected by 40 rainfall stations of the Ethiopian National Meteorological Services Agency. Each sample zone (an area whose size is in between a wereda and a killil) was matched up to the closest rainfall station, providing there was at least one in the area.[22] The other variables we have on community level infrastructure are on the type of roads. We use five dummy variables, road type 1 being the best conditioned road, followed by type 2, 3 and so forth.

Although we use the community infrastructure and agro-climate variables discussed, we do not have critical information on labor markets such as wages. Of course wages are the most important set of variables to examine any types of labor supply. However, as we discuss in section II, farm labor markets are not active or absent in rural Ethiopia. Under thin farm labor markets, shadow wages become an important factor in farm labor supply determination. For children, agro-climate variables, asset ownership, and

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[21] These years were chosen because earlier years had many missing observations for many stations.

[22] As mentioned, the Afar area was the one that did not have a rainfall station close by (and the nearest did not have 1995 data). We consequently dropped that area, which only contains 86 households. All weredas within a zone were assigned the same long-run median rainfall.

access to schooling should have significant effects on their shadow wages. Access to schooling increases children's shadow wage because attending school may increase their life time earnings. However, there may exist other important community level variables which may cause biases in estimated coefficients but have to be omitted. Therefore in several specifications, we use wereda fixed effect models.

3.4. Results

We first present results from "reduced form" child farm labor supply models with ordered logits. These will omit any food aid effects, but include household composition. Second, we will compare coefficients of child composition from logits and conditional logits. And third, we will present results on differential effects of food aid between boys and girls, boys and female adults, and girls and female adults.

3.4.1. Results on Reduced Forms

Child Composition

In areas with thin farm labor markets, households need to fill their farm labor demand with their household members. For children, the presence of older siblings and others in the same age group, in particular, is considered to have significant effects on younger children's time allocation (see Behrman 1997 for a survey on siblings studies). An additional child, older or younger, in the same household may take household resources away from other children; but, an additional older child may bring resources in.

The results in the column 1 and 2 of Table 3.3 indicate that having older boys and

girls decreases the probability of boys aged 7 to 10 working on farm; the magnitude is larger for having older boys than having older girls. To capture meaningful interpretations, we conduct some simulations on having various numbers of older boys and girls in the same household.[23] According to these simulations, the probability of boys aged 7 to 10 working full time on farm decreases by 7.0 percent from 30.7 percent as the number of older boys in the same household increases from zero to one and by 6.4 percent from 30.1 percent as the number of older girls increases from zero to one.

For girls aged 7 to 10 we have similar results: having older boys in the same household decreases the probability of girls aged 7 to 10 working full time on farm (Table 3.4). According to simulation results, the probability of girls aged 7 to 10 working full time working on farm decreases by 5.3 percent from 20.9 percent as the number of older boys increases from zero to one. On the other hand, having older girls does not have significant effects; although, the sign is negative. These results suggest that older boys are more productive in farm production than girls aged 7 to 10, but older girls may not be more productive or they have higher opportunity costs, probably in home production, than girls aged 7 to 10.

The primary working place of girls is in home production engaging in various household activities. One can see the evidence of this in coefficients of the number of boys aged less than 6 in the column 3 and 4 of Table 3.4. These coefficients indicate that

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[23] To carry out these simulations, we set the number of older boys in the household at 0 after we estimate the model, then we predict the probability of working for all younger boys and take the average. Next, we set the number of older boys at 1, and predict the probability and take the average. We repeat this for the number of older boys equal to 2.

having more boys aged less than 6 reduces the probability of girls aged 11 to 14 (the older age category) working on farm significantly. This is consistent with the idea that these girls are taking care of boys aged less than 6. Interestingly, having girls aged less than 6 does not have significant effects on girls' probability of working on farm.

An interesting finding in Table 3.4 is that the estimated coefficients of female adults aged 15 to 49 and elderly aged over 50 are *positive* on the probability of girls in the both age categories working on farm, indicating that having more female adults and elderly *increases* the probability of girls working on farm. And also the opposite is true, having more girls aged 11 to 14 increases the probability of female adults working on farm (the column 2 in Table 3.5). One interpretation is that having more female adults and elderly, already engaging in home production, reduces girls' labor productivity in home production where labor inputs may have rapid diminishing return. Thus, having one more female adult in the household may push a girl into farm production.

Distance to Schools

It is considered that there is a trade-off between schooling and working for children (e.g., Rosenzweig and Evenson, 1977). To find this trade-off, previous empirical studies used some proxies of schooling costs, such as availability of schools (Rosenzweig, 1981), the distance to the nearest school (Grootaert, 1999), or average out-of-pocket expenditures on schooling (Cartwright, 1999). Using these proxies raises some concerns on the endogenous school placement, omitted variable problems caused by unobservable regional characteristics, and endogeneity of average school expenditure (Pitt, Rosenzweig,

and Gibbons, 1993). Despite its problems, we use the wereda level average distance to the nearest primary school as a proxy of schooling costs, because no better proxy for schooling costs is available.

In fact, results from female adults' reduced form farm labor supply suggest a major problem in interpreting results: the distance to the nearest primary school is picking up other regional factors. As one can see in Table 3.5, the estimated coefficient of the distance to the nearest primary school is positive and significant for the probability of female adults working on farm. From this result, we expect to find similar results that children who live in areas farther away from primary schools have higher probabilities of working on farm even without the trade-off between schooling and working on farm. Thus, we need to be cautious in interpretations; the estimated coefficients may be overestimated.

The estimated coefficients of the distance to the nearest primary school are positive and significant (except for old girls) as expected. According to our simulation results, the probability of boys aged 7 to 10 working full time will decrease by 3.4 percent from 30.8 percent if the distance to the nearest primary school is shortened from the 75th to 25th percentile by 5.1 km. The probability of boys aged 11 to 14 working full time on farm will decrease by 3.6 percent from 51.9 percent. The probabilities of girls in the younger and older age categories will decrease by 3.0 percent from 16.3 percent and by 0.6 percent from 27.0 percent, respectively. Because of possible overestimations, we should suspect that the real effects of changing the distance to primary schools on child farm labor supply are smaller than these results.

These results suggest one important policy implication: providing schools is not enough to reduce child farm labor supply considerably. In our data, about 38 percent of boys and 20 percent of girls work full time on farm. Less than 4 percent or possibly smaller changes in probabilities of working full time on farm, by reducing the distance to primary schools by 5 km, seem too insignificant against the high percentages of children working full time. One possible approach is to make schooling more attractive by providing targeted enrollment subsidies. For example, programs that provide cash or in-kind transfers targeted to poor families conditioned on child school attendance have become popular recently (Grootaert and Patrinos, 1999). However, as Ravallion and Wodon (1999) show, these special programs may not reduce child farm labor significantly either.

The results on child composition seem to suggest that the absence of schools is not the major determinants of child farm labor supply, but that the absence of farm labor is a major determinant of child labor supply in rural Ethiopia.

Household Characteristics

The education of household heads reduces the probabilities of children working on farm; the effects are larger for boys and girls in the older age category (aged 10 to 14). For boys, the simulation results indicate that the probability of boys aged 7 to 10 working full time on farm decreases by 3.7 percent from 28.1 percent if their household heads have some education, and for boys aged 11 to 14, their probability decreases by 13.7 percent from 46.8 percent. For girls, the probability of girls aged 7 to 10 working full time on farm

decreases by 3.1 percent from 18.9 percent, and for girls aged 11 to 14 the probability decreases by 6.2 percent from 26.2 percent. The negative effects of head's education are consistent with findings from other empirical studies on child labor supply (Grootaert and Patrions, 1999).

One might think that boys work more in female headed households because male adults are not available. The results indicate the opposite, boys work less on farm in female headed households than boys in male headed households. The negative effects of female headed household suggests two possibilities. First, female heads choose activities that do not require male labor, such as non-farm activities. Second, female heads value boys' non-working time more than male heads do. It is not clear which case is more plausible in rural Ethiopia.

In various developing countries, children take care of domestic animals (Bonnet, 1993). The results imply that this is also the case in rural Ethiopia. The estimated coefficients of big animals are significantly positive for boys, especially for boys in the older age category (Table 3.3) and for girls in the younger age category (Table 3.4).

Individual Characteristics

As we see in Figure 3.1, the probability of working increases rapidly in early ages of boys and girls: the estimated coefficients of age in Table 3.3 and 3.4 are larger for boys and girls in the younger age category than boys and girls in the older age category, consistent with Figure 3.1.

Girls aged in the older age category who are *relatives* (either sister, relative, or no

relative) to their household heads have a lower probability of working on farm; the estimated coefficient is significant at 10 percent with wereda fixed effects. No significant effects were found on boys who are *relatives*.

Regional Characteristics

Regional characteristics have significant effects on boys' probability of working on farm but not for girls. Boys work more in areas with higher average rainfall and in higher elevation (Table 2). Higher rainfall may indicate higher agricultural labor demand in the areas, while higher elevation may indicate less active farm labor markets. Combined, these results suggest that boys work more where farm labor demand on farm production is high and farm labor markets are less active. Having good rainfall shocks in the previous year, 1994, reduces the probability of working for boys, presumably the income effects. But the rainfall shocks in the current year do not have any impacts on the probability of working.

3.4.2. Results on Reduced Forms with Household Fixed Effects

To estimate conditional logits, we need to exclude children who live in households with only one child or no variation in the dependent variable among children, leaving 1,561 children in 577 households. We estimate logits and conditional logits by using the same sample so that we can compare the estimated coefficients. If estimated coefficients from logits are consistent, then estimated coefficients from conditional logits are consistent but less efficient. The Hausman test can be used to test whether there is a statistically significant difference between the estimated coefficients from logits and

conditional lgits (Greene, 2000: pp841). Because we are unable to estimate coefficients of variables that are common to all households members in conditional logits, the only variables that we can compare are variables that vary across individuals; in this case, *child* specific variables (i.e., individual characteristics and child composition) and variables with gender dummy. We are especially interested in changes in estimated coefficients of child composition and food aid that we suspect may be endogenous.

The results in Table 3.6 indicate that the estimated coefficients of child composition with logits in the column 1 are statistically different from the ones with conditional logits in the column 2; the Hausman test statistics is 18.0 (k=4) that is sufficiently large to reject the null hypothesis at 1 percent level. Especially, the estimated coefficients of number of younger and older boys increase when households fixed effects are controlled for. The estimated coefficient of number of younger boys nearly doubles from 1.079 in the column 1 to 1.975 in the column 2 of Table 3.6, and the estimated coefficient of number of older boys changes from -1.039 in the column 1 to 0.487 in the column 2. The estimated coefficients of number of younger and older girls do not change much, the standards errors get larger, but this is what we expect in conditional logits. One possible explanation for changes in boys' coefficients is that boys composition is endogenous in child labor supply equation; the number of younger and older boys are correlated with unobserved household characteristics that are associated with probability that children work on farm.

3.4.3. Results on Differential Effects

The results in the column 3 of Table 3.6 (logits) indicate that receiving food aid through FD does not have significant effects on the probability of boys working on farm but has significantly larger positive effects on the probability of girls, and that participating in FFW has positive effects on the probability of boys working on farm but has significantly smaller effects on the probability of girls. However, as discussed in Section 3.3.2 these estimated coefficients might be biased because of unobservable household characteristics. Thus we present the results from conditional logits in the column 4. Because percapi ta values received from FD and FFW are common to all households members, we are unable to estimate their coefficients.

The estimated coefficients of interaction terms with gender dummy (1 for girls) change downward.[24] Because we are unable to estimate the level effects of FD and FFW, we can interpret the results in two ways: receiving food aid from FD either (i) decreases the probabilities of boys and girls working on farm with smaller negative effects on girls, or (ii) increases the probabilities of boys and girls working on farm with larger positive effects on girls. Although, the second interpretation is consistent with the results with logits in the column 3 (and with Figure 3.2 to some extent), we are unable to chose the second interpretation because the estimated coefficient of FD with logits might be biased in either way.

The results on the negative coefficient of interaction term between per capita value received from FFW and gender dummy can be interpreted in two ways also: participating

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[24] The Hausman statistics on these two interaction terms was negative, which is possible when we compare coefficients between logits and conditional logits.

in FFW either (i) increases the probabilities of boys and girls working on farm with smaller positive effects on girls, or (ii) decreases the probabilities of boys and girls working on farm with larger negative effects on girls. The results with logits in the column 3 are consistent with the first interpretation. Again we are unable to chose one out of these two interpretations. Yet, because the estimated coefficient of per capita value received from FFW is positive and significant at 10 percent in the column 3, the first interpretation might be a better interpretation. This interpretation suggests that boys are substituting in farm production when their households participate in FFW, or girls are working off-farm, possibly working more in home production or participating in FFW themselves, when their households participate in FFW.

The results on differential effects of food aid between boys and female adults in Table 3.7 are similar to the results between boys and girls. The signs of estimated coefficients of interaction terms with the girl dummy in the column 3 and 4 of Table 3.6 are the same as the ones with the female adult dummy in the column 1 and 2 of Table 3.7; although, magnitudes are smaller with the female adult dummy. Again, we have two interpretations on the coefficients of interaction terms and are unable to chose a better interpretation. However, at least the results indicate similar differential effects between boys and girls and between boys and female adults.

The results on differential effects between girls and female adults in the column 3 and 4 of Table 3.7 are along with other results. Receiving food aid from FD has relatively larger positive effects on girls than female adults. From all results on the differential effects of receiving food aid from FD, we may conclude that receiving food aid from FD has

relatively larger positive effects on girls than female adults, and relatively larger positive effects on female adults than boys. The size of estimated coefficient of interaction term comparing boys v.s. girls (0.024) is about the sum of sizes of estimated coefficients of interaction term comparing boys v.s. female adults (0.009) and girls v.s. female adults (0.017).

The results on FFW in the column 3 and 4 of Table 3.7 indicate that there is no significant differential effects between girls and female adults. Combined with other results, we may conclude that participating in FFW has relatively larger positive effects on the probability of boys working on farm than girls and female adults, but has no significant differential effects between girls and female adults.

These results suggest that different types of income transfer programs will have different outcomes on boys' and girls' farm labor supply. Although it is difficult to investigate why FD and FFW have differential effects between genders and age groups without knowing the level effects of food aid, it is important to recognize such differences.

3.5. Conclusions

In this chpter, we have considered the effects of household demographic composition and food aid on child farm labor supply. Work requirement on farm is a major constraint on schooling in rural Ethiopia. Better understandings on the determinants of child farm labor will help governments to carry out various policies to increase school attendance effectively. To examine the determinants of child farm labor supply, we estimated reduced form child farm labor supply with ordered logits. The results indicate

that lack of farm labor is a major determinant in child farm labor supply: having one more male adult decreases the probabilities of children in the older age category (aged 11 to 14) working on farm. For girls in the older age category, having one more female adult and elderly *increases* the probability working on farm. This result may suggest that girls in the older age category have lower productivity in home production when more female adults are available in the households.

Some of household demographic compositions, especially child composition, could be correlated with unobserved households characteristics in child farm labor supply. To avoid biased estimators caused by unobservable household characteristics, we estimate child farm labor supply with household fixed effects by conditional logits. The results indicate that a child, especially a boy, has higher probability of working on farm if he or she is living with younger children, suggesting that older children living with younger children are reducing resource constraints by working on farm. Thus, reducing resource constraints through food aid programs may reduce child farm labor supply, especially older children's.

Different types of food aid programs may have different effects, and even a food aid program may have different effects between boys and girls. For instance, bivariate relationships between probability of working and age (Figure 3.2) indicate that girls aged 12 and above in the households who participated in food for work programs had lower probability of working on farm than girls in the households who did not receive any type of food aid, suggesting a possibility that girls aged 12 and above participated in food for work programs by reducing their working time on farm. Boys in the households who

participated in food for work programs did not have significantly different probability from boys in households who did not receive any type of food aid. Although these bivariate relationships do not indicate any causality, they suggest that a food aid program may have different effect on child farm labor supply between boys and girls.

The economic results on food aid's effects on child farm labor supply indicate that different types of food aid programs (free distribution and food for work) have opposite differential effects on child labor supply between boys and girls. More specifically, receiving free distribution has *relatively* larger positive effects on the probability of girls working on farm than boys, while participating in food for work has *relatively* larger positive effects on the probability of boys working on farm than girls. Therefore the results suggest that a direct income transfer program, such as free distribution, and an employment program, such as food for work, have different effects on boys' and girls' farm labor supply. This may be because that households have to reallocate their adult and child labor when they participate in food for work programs, while they do not need to change their labor allocation to receive food aid from free distribution.

Table 3.3. Reduced Form Farm Labor Supply for Boys Aged 7 to 14 (Ordered Logit)

	Boys aged 7 to 10		Boys aged 11 to 14	
		Wereda FE		Wereda FE
	(1)	(2)	(3)	(4)
Individual Characteristics				
Age	0.306	0.581	0.127	0.124
	(5.12)**	(6.91)**	(1.81)	(1.25)
Child w/step mom/dad (0,1)	0.025	0.191	0.279	0.173
	(0.13)	(0.70)	(1.33)	(0.61)
Child, relative (0,1)	-0.043	-0.380	0.336	0.277
	(0.18)	(1.05)	(1.41)	(0.84)
Child Composition				
Boys 0-6 (#)	0.156	0.110	-0.017	-0.035
	(2.06)*	(1.02)	(0.20)	(0.27)
Girls 0-6 (#)	0.002	0.090	-0.101	-0.078
	(0.03)	(0.84)	(1.13)	(0.65)
Younger boys (7-14)	0.133	0.060	0.054	0.197
	(0.84)	(0.29)	(0.58)	(1.55)
Younger girls (7-14)	0.086	-0.025	0.087	0.210
	(0.50)	(0.11)	(0.92)	(1.59)
Older boys (7-14)	-0.362	-0.515	-0.313	-0.267
	(4.00)**	(4.09)**	(1.53)	(1.00)
Older girls (7-14)	-0.384	-0.474	-0.156	-0.136
	(3.93)**	(3.46)**	(0.70)	(0.46)
Other Demographic Composition				
Male adults 15-49 (#)	-0.028	-0.089	-0.286	-0.303
	(0.36)	(0.85)	(3.83)**	(2.92)**
Female adults 15-49 (#)	0.074	0.025	-0.034	0.138
	(0.86)	(0.21)	(0.36)	(1.04)
Male Elderly 50- (#)	-0.041	-0.080	-0.030	-0.351
	(0.28)	(0.40)	(0.19)	(1.60)
Female Elderly 50- (#)	0.238	0.538	0.046	0.255
	(1.29)	(2.06)*	(0.25)	(0.96)
Household Characteristics				
Household head's education (0,1)	-0.242	-0.276	-0.420	-0.783
	(1.80)	(1.44)	(2.68)**	(3.54)**
Female headed household (0,1)	-0.025	-0.381	-0.820	-1.105
	(0.09)	(0.99)	(2.82)**	(2.69)**
Female headed, but married (0,1)	0.067	-0.216	-0.408	-0.769
	(0.20)	(0.47)	(1.37)	(1.76)
Land owned (ha)	0.008	0.028	-0.051	-0.061
	(0.59)	(1.71)	(2.03)*	(1.99)*
Value of big animals ('000birr)	0.032	0.023	0.016	0.106
	(1.38)	(0.63)	(0.57)	(2.47)*
Value of chickens (birr)	0.000	0.000	0.001	-0.001
	(0.11)	(0.27)	(0.48)	(0.72)
Muslim (0,1)	-0.361	-0.267	0.088	0.155
	(1.93)	(0.75)	(0.43)	(0.40)
Protest (0,1)	-0.043	0.681	0.196	0.519
	(0.22)	(2.10)*	(0.89)	(1.36)
Livestock household (0,1)	0.516	-0.298	-0.350	-0.097
	(0.81)	(0.26)	(0.50)	(0.13)

Table 3.3. Continued.

	(1)	(2)	(3)	(4)
Regional Characteristics				
Distance to Primary School (km)	0.046		0.041	
	(2.47)*		(1.96)*	
Distance to Water Source (km)	0.021		0.008	
	(1.85)		(0.73)	
Distance to Health Center (km)	-0.008		-0.002	
	(0.79)		(0.16)	
Average Rainfall (mm)	0.001		0.002	
	(2.20)*		(3.04)**	
Rainfall shocks in 1994 (mm)	-0.002		-0.003	
	(2.26)*		(3.54)**	
Rainfall shocks in 1995 (mm)	0.000		0.001	
	(0.13)		(1.08)	
Elevation	-0.001		0.000	
	(4.17)**		(2.07)*	
Road Dummy 1 (Best road)	0.466		0.542	
	(2.02)*		(2.32)*	
Road Dummy 2	1.120		0.453	
	(3.59)**		(1.17)	
Road Dummy 3	-0.539		-0.645	
	(2.43)*		(2.44)*	
Road Dummy4	0.012		0.413	
	(0.05)		(1.63)	
Road Dummy 5 (Worst)	-0.391		-0.332	
	(1.58)		(1.17)	
	Domain Dummies	Wereda Dummies	Domain Dummies	Wereda Dummies
Observed % (Full, Half, No Time)	30, 27, 43	27, 28, 45	50, 35, 15	43, 38, 18
Wald tests: Child's relation with head	0.07 [0.97]	2.16 [0.34]	2.89 [0.24]	0.84 [0.66]
Siblings (7-14)	27.4 [0.00]**	24.7 [0.00]**	3.33 [0.50]	4.97 [0.29]
Demographic composition	6.12 [0.41]	5.82 [0.44]	16.7 [0.01]*	10.4 [0.11]
Road dummies	16.3 [0.01]**		11.2 [0.05]*	
Regional dummies	84.2 [0.00]**	273 [0.00]**	61.0 [0.00]**	188 [0.42]
Log Likelihood	-1207	-845.5	-945.9	-657.9
Observations	1251	1028	1046	793

Note: Dependent Variable: Working time on farm (Full, Half, No time). Absolute values of z-statistics are in parentheses. P-values are in brackets. * indicates significant at 5% level; ** indicates significant at 1% level.

Table 3.4. Reduced Form Farm Labor Supply of Girls aged 7 to 14 (Ordered Logit)

	Girls aged 7 to 10		Girls aged 11 to 14	
		Wereda FE		Wereda FE
	(1)	(2)	(3)	(4)
Individual Characteristics				
Age	0.415	0.680	0.029	0.156
	(5.95)**	(6.58)**	(0.39)	(1.36)
Child w/step mom/dad (0,1)	0.027	-0.028	-0.053	-0.155
	(0.12)	(0.10)	(0.25)	(0.44)
Child, relative (0,1)	0.032	0.008	-0.140	-0.783
	(0.12)	(0.02)	(0.59)	(1.93)
Child Composition				
Boys 0-6 (#)	-0.043	-0.083	-0.218	-0.323
	(0.52)	(0.68)	(2.37)*	(2.15)*
Girls 0-6 (#)	0.056	0.019	-0.133	-0.109
	(0.63)	(0.16)	(1.26)	(0.68)
Younger boys (7-14)	-0.076	-0.111	0.101	0.166
	(0.40)	(0.43)	(0.96)	(0.95)
Younger girls (7-14)	-0.213	-0.035	0.105	-0.148
	(1.10)	(0.13)	(0.95)	(0.86)
Older boys (7-14)	-0.324	-0.505	-0.569	-0.946
	(3.25)**	(3.52)**	(2.66)**	(2.68)**
Older girls (7-14)	-0.342	-0.187	-0.404	-0.794
	(3.01)**	(1.19)	(1.58)	(1.99)*
Other Demographic Composition				
Male adults (#)	-0.056	-0.106	-0.111	-0.348
	(0.71)	(0.92)	(1.42)	(2.87)**
Female adults (#)	0.096	0.235	0.070	0.322
	(0.99)	(1.74)	(0.78)	(2.12)*
Elders, male>=50 (#)	0.109	-0.192	-0.404	-0.244
	(0.68)	(0.86)	(2.34)*	(0.89)
Elders, female>=50 (#)	0.050	0.132	0.137	0.462
	(0.27)	(0.44)	(0.73)	(1.53)
Household Characteristics				
Household head's education (0,1)	0.005	-0.308	-0.519	-0.519
	(0.04)	(1.33)	(3.05)**	(1.91)
Female headed household (0,1)	-0.081	0.044	-0.325	0.134
	(0.27)	(0.11)	(1.13)	(0.30)
Female headed, but married (0,1)	0.499	0.681	-0.456	-0.711
	(1.49)	(1.45)	(1.17)	(0.98)
Land owned (ha)	-0.015	-0.006	-0.011	-0.019
	(1.20)	(0.38)	(0.84)	(1.27)
Value of big animals ('000birr)	0.056	0.111	-0.015	0.034
	(1.82)	(2.27)*	(0.48)	(0.63)
Value of chickens ('000birr)	-0.001	-0.002	0.000	-0.005
	(0.78)	(0.96)	(0.29)	(2.01)*
Muslim (0,1)	-0.159	0.081	-0.197	0.083
	(0.75)	(0.18)	(0.84)	(0.16)
Protest (0,1)	-0.053	-0.179	0.224	0.606
	(0.23)	(0.45)	(0.85)	(1.36)
Livestock household (0,1)	-0.746	0.050	0.770	-0.091
	(0.88)	(0.05)	(1.17)	(0.11)

Table 3.4. Continued.

	(1)	(2)	(3)	(4)
Regional Characteristics				
Distance to Primary School (km)	0.064		0.009	
	(3.26)**		(0.47)	
Distance to Water Source (km)	0.006		0.012	
	(0.58)		(0.96)	
Distance to Health Center (km)	-0.004		0.014	
	(0.40)		(1.05)	
Average Rainfall (mm)	0.000		0.000	
	(0.21)		(0.00)	
Rainfall shocks in 1994 (mm)	-0.002		0.000	
	(1.73)		(0.08)	
Rainfall shocks in 1995 (mm)	0.000		0.000	
	(0.81)		(0.24)	
Elevation	-0.001		-0.001	
	(3.04)**		(2.71)**	
Road Dummy 1 (Best road)	-0.140		0.375	
	(0.56)		(1.25)	
Road Dummy 2	1.414		0.512	
	(3.79)**		(1.21)	
Road Dummy 3	-0.749		-0.338	
	(2.88)**		(1.21)	
Road Dummy4	-0.001		0.320	
	(0.00)		(1.18)	
Road Dummy 5 (Worst)	-0.942		-0.585	
	(3.08)**		(1.83)	
	Domain Dummies	Wereda Dummies	Domain Dummies	Wereda Dummies
Observed % (Full, Half, No Time)	16, 27, 58	18, 29, 53	27, 38, 35	24, 39, 36
Wald tests: Child's relation with head	0.02 [0.99]	0.01 [0.99]	0.35 [0.84]	3.82 [0.15]
Siblings (7-14)	17.7 [0.00]**	13.0 [0.01]*	9.87 [0.04]*	12.2 [0.02]
Demographic composition	3.37 [0.76]	4.33 [0.63]	10.8 [0.09]	17.4 [0.01]**
Road dummies	20.2 [0.00]**		6.34 [0.28]	
Regional dummies	70.6 [0.00]**	222 [0.01]*	84.3 [0.00]**	155 [0.15]
Log Likelihood	-930.9	-630.3	-810.3	-441.1
Observations	1107	833	857	541

Note: Dependent Variable: Working time on farm {Full, Half, No time}. Absolute values of z-statistics are in parentheses. P-values are in brackets. * indicates significant at 5% level; ** indicates significant at 1% level.

Table 3.5. Reduced Form Farm Labor Supply for Female Adults (15-) (Ordered Logit)

	Female Adults over 15 years-old	
		Wereda FE
	(1)	(2)
Individual Characteristics		
Age 15-25, splined	0.045	0.052
	(4.30)**	(4.49)**
Age 26 -	-0.028	-0.034
	(8.80)**	(9.62)**
Child Composition		
Boys 0-6 (#)	-0.023	0.006
	(0.60)	(0.13)
Girls 0-6 (#)	-0.003	0.010
	(0.06)	(0.22)
Boys 7-10 (#)	-0.005	0.037
	(0.10)	(0.70)
Girls 7-10 (#)	0.081	0.064
	(1.64)	(1.14)
Boys 11-14 (#)	0.036	0.070
	(0.70)	(1.20)
Girls 11-14 (#)	0.067	0.139
	(1.21)	(2.23)*
Other Demographic Composition		
Male adults (#)	-0.123	-0.153
	(3.72)**	(4.04)**
Female adults (#)	-0.038	-0.026
	(1.01)	(0.60)
Elders, male>=50 (#)	-0.006	-0.023
	(0.08)	(0.28)
Elders, female>=50 (#)	-0.152	-0.316
	(2.09)*	(3.74)**
Household Characteristics		
Household head's education (0,1)	-0.124	-0.139
	(1.84)	(1.80)
Female headed household (0,1)	0.456	0.644
	(4.55)**	(5.57)**
Female headed, but married (0,1)	0.870	0.900
	(6.70)**	(6.00)**
Land owned (ha)	-0.018	-0.014
	(2.55)*	(1.87)
Value of big animals ('000birr)	0.031	0.045
	(1.00)	(1.24)
Value of chickens (birr)	0.005	0.004
	(1.58)	(1.29)
Muslim (0,1)	-0.160	-0.140
	(1.79)	(1.02)
Protest (0,1)	0.037	0.045
	(0.38)	(0.36)
Livestock household (0,1)	-1.989	-2.500
	(6.52)**	(7.03)**

Table 3.5. Continued.

	(1)	(2)
Regional Characteristics		
Distance to Primary School (km)	0.025	
	(2.97)**	
Distance to Water Source (km)	0.016	
	(3.10)**	
Distance to Health Center (km)	0.008	
	(1.73)	
Average Rainfall (mm)	0.000	
	(1.04)	
Rainfall shocks in 1994 (mm)	0.000	
	(1.05)	
Rainfall shocks in 1995 (mm)	0.000	
	(0.27)	
Elevation	0.000	
	(2.45)*	
Road Dummy 1 (Best road)	0.144	
	(1.29)	
Road Dummy 2	-0.498	
	(3.36)**	
Road Dummy 3	-0.116	
	(1.09)	
Road Dummy4	0.391	
	(3.64)**	
Road Dummy 5 (Worst)	-0.479	
	(3.94)**	
Observed % (Full, Half, No Time)	34, 39, 27	0.34, 0.39, 0.28
Wald tests: Demographic (7-14)	5.14 [0.27]	8.64 [0.07]
Demographic composition	21.8 [0.00]**	35.2 [0.00]**
Road dummies	50.5 [0.00]**	
Regional dummies	520 [0.00]**	1616 [0.00]**
Log Likelihood	-4985	-4266
Observations	5281	5253

Note: Dependent Variable: Working time on farm {Full, Half, No time}. Absolute values of z-statistics are in parentheses. P-values are in brackets. * indicates significant at 5% level; ** indicates significant at 1% level.

Table 3.6. Child Farm Labor Supply with Household Fixed Effects (Boys vs. Girls)

	Reduced Form		Conditional Farm Labor Supply	
	Logits[A]	Conditional Logits	Logits	Conditional Logits
	(1)	(2)	(3)	(4)
Food Aid				
Per capita Value from FD			4.0*10e-4	
			(0.02)	
Per capita Value from FFW			0.042	
			(1.77)	
*Food Aid * d (1 for girls)*				
Per capita Value from FD * d			0.039	0.024
			(2.17)*	(1.46)
Per capita Value from FFW * d			-0.048	-0.063
			(2.22)*	(2.38)*
Individual Characteristics				
Dummy: d (1 for girls)	-4.542	-3.348	-4.575	-3.510
	(1.61)	(1.14)	(1.61)	(1.18)
Age (7-10)	0.929	0.612	0.927	0.622
	(5.30)**	(3.15)**	(5.24)**	(3.11)**
Age (10-14)	0.339	0.243	0.356	0.242
	(2.14)*	(1.26)	(2.22)*	(1.23)
Age (7-10) * d	0.421	0.257	0.417	0.257
	(1.44)	(0.90)	(1.42)	(0.89)
Age (10-14) * d	-0.349	-0.138	-0.354	-0.097
	(1.73)	(0.64)	(1.74)	(0.45)
Step child	0.190	-0.387	0.232	-0.446
	(0.49)	(0.53)	(0.59)	(0.60)
Child, relative	-0.390	-0.836	-0.352	-0.861
	(0.95)	(1.51)	(0.85)	(1.53)
Child Composition				
Number of younger boys (7-14)	0.927	1.975	0.949	1.843
	(3.10)**	(2.14)*	(3.17)**	(1.97)*
Number of younger girls (7-14)	1.307	1.424	1.407	1.328
	(4.22)**	(1.63)	(4.46)**	(1.46)
Number of older boys (7-14)	-1.268	0.487	-1.283	0.313
	(4.63)**	(0.60)	(4.65)**	(0.38)
Number of older girls (7-14)	-0.283	-0.390	-0.230	-0.416
	(1.01)	(0.48)	(0.82)	(0.49)
*Child Composition * d (1 for girls)*				
Number of younger boys (7-14) * d	-0.664	-1.032	-0.643	-0.916
	(1.76)	(2.20)*	(1.69)	(1.94)
Number of younger girls (7-14) * d	-0.471	-0.387	-0.581	-0.518
	(1.26)	(0.96)	(1.52)	(1.25)
Number of older boys (7-14) * d	0.028	0.153	0.038	0.188
	(0.07)	(0.40)	(0.10)	(0.48)
Number of older girls (7-14) * d	-0.188	0.470	-0.250	0.373
	(0.48)	(1.04)	(0.63)	(0.81)
*Demographic Composition * d (1 for girls)*				
Boys 0-6 (#) * d	-0.077	-0.078	-0.089	-0.047
	(0.32)	(0.33)	(0.37)	(0.19)
Girls 0-6 (#) * d	-0.193	-0.355	-0.151	-0.339
	(0.76)	(1.40)	(0.59)	(1.33)
Male adults (#) * d	-0.235	-0.332	-0.242	-0.304
	(1.11)	(1.53)	(1.14)	(1.41)
Female adults (#) * d	0.520	0.308	0.567	0.372
	(1.92)	(1.08)	(2.08)*	(1.29)
Elders, male>=50 (#) * d	-0.978	-0.753	-1.110	-0.851
	(2.20)*	(1.73)	(2.47)*	(1.91)
Elders, female>=50 (#) * d	-0.081	-0.016	0.009	0.064
	(0.15)	(0.03)	(0.02)	(0.13)

Table 3.6. Continued.

	(1)	(2)	(3)	(4)
*Household Char. * d (1 for girls)*				
Household head's education (0,1)	0.019	0.005	0.019	-0.146
	(0.04)	(0.01)	(0.04)	(0.33)
Female headed household (0,1)	-0.260	-0.648	-0.260	-0.916
	(0.35)	(0.92)	(0.35)	(1.28)
Female headed, but married (0,1)	0.451	-0.185	0.451	-0.397
	(0.50)	(0.22)	(0.50)	(0.46)
Land owned (ha)	0.012	0.064	0.012	0.046
	(0.11)	(0.66)	(0.11)	(0.47)
Value of big animals ('000birr)	0.024	-0.009	0.024	0.008
	(0.33)	(0.12)	(0.33)	(0.12)
Value of chickens (birr)	0.004	0.004	0.004	0.004
	(1.08)	(1.07)	(1.08)	(1.18)
Livestock household (0,1)	3.470	2.313	3.470	2.621
	(1.77)	(1.27)	(1.77)	(1.64)
Muslim (0,1) * d	-1.265	-1.088	-1.265	-0.949
	(2.99)**	(2.48)*	(2.99)**	(2.15)*
Protest (0,1) * d	-1.589	-1.214	-1.589	-1.148
	(2.65)**	(2.23)*	(2.65)**	(2.07)*
Wald test: Food Aid * d				7.76 [0.02]*
Child Composition	42.6 [0.00]**	13.6 [0.01]**	44.7 [0.00]**	12.9 [0.01]*
Child Composition * d	3.62 [0.46]	5.60 [0.23]	3.97 [0.41]	4.73 [0.32]
Demographics * d	9.44 [0.15]	6.96 [0.32]	10.9 [0.09]	7.41 [0.28]
Household char. * d	4.85 [0.56]	3.88 [0.69]	6.79 [0.34]	5.96 [0.43]
Log Likelihood	-508.6	-195.8	-503.9	-191.5
Number of individuals	1561	1561	1561	1561
(Households)	577	577	577	577

Note: Absolute value of z-statistics are in parentheses. P-values are in brackets. * indicates significant at 5% level; ** indicates significant at 1% level. A) Logits also include demographic, household characteristics variables, and wereda dummies.

Table 3.7. Differential Effects Between Children and Female Adults

	Boys vs. Female Adults		Girls vs. Female Adults	
	Logits	Conditional logits	Logits	Conditional logits
	(1)	(2)	(3)	(4)
Food Aid				
Per capita Value of FD	-0.003		0.016	
	(0.56)		(1.44)	
Per capita Value of FFW	0.020		0.004	
	(2.52)*		(0.40)	
*Food Aid * d (female adult=1)*				
Per capita Value of FD * d	0.017	0.009	-0.018	-0.017
	(1.98)*	(1.45)	(1.53)	(1.94)
Per capita Value of FFW * d	-0.023	-0.015	-0.014	-0.010
	(2.68)**	(2.02)*	(1.25)	(1.12)
Individual Characteristics				
Dummy (d)[3] 1 for female adult	-3.115	-2.452	0.731	-0.210
	(5.33)**	(4.68)**	(1.19)	(0.36)
Age (7-10)	1.033	0.813	0.920	0.708
	(11.06)**	(9.47)**	(8.01)**	(6.67)**
Age (10-14)	0.668	0.518	0.471	0.363
	(7.57)**	(6.40)**	(5.32)**	(4.31)**
Age (15-25)	0.067	0.036	0.086	0.033
	(2.69)**	(1.45)	(2.96)**	(1.20)
Age (25-50)	-0.015	-0.001	-0.019	-0.001
	(1.39)	(0.11)	(1.48)	(0.09)
Age (50-)	-0.120	-0.097	-0.135	-0.105
	(6.93)**	(6.10)**	(7.05)**	(5.96)**
*Demog. Composition * d (f. adult=1)*				
Boys 0-6 (#) * d	-0.034	-0.020	0.111	0.083
	(0.25)	(0.16)	(0.72)	(0.58)
Girls 0-6 (#) * d	-0.144	-0.118	-0.049	0.001
	(1.04)	(0.98)	(0.30)	(0.01)
Boys 7-10 (#) * d	-0.173	-0.210	0.101	0.079
	(1.03)	(1.32)	(0.46)	(0.39)
Girls 7-10 (#) * d	-0.110	-0.138	-0.512	-0.266
	(0.60)	(0.84)	(2.58)**	(1.40)
Boys 11-14 (#) * d	0.340	0.439	0.513	0.354
	(1.94)	(2.64)**	(2.46)*	(1.85)
Girls 11-14 (#) * d	0.526	0.404	0.241	0.469
	(2.70)**	(2.26)*	(1.12)	(2.22)*
Male adults (#) * d	-0.012	-0.023	-0.109	-0.053
	(0.10)	(0.21)	(0.87)	(0.45)
Female adults (#) * d	-0.060	-0.063	-0.551	-0.251
	(0.44)	(0.50)	(3.71)**	(1.76)
Elders, male>=50 (#) * d	-0.719	-0.605	-0.490	-0.384
	(2.88)**	(2.66)**	(1.72)	(1.49)
Elders, female>=50 (#) * d	-0.715	-0.472	-0.841	-0.519
	(2.70)**	(1.94)	(3.20)**	(2.12)*

Table 3.7. Continued.

	(1)	(2)	(3)	(4)
*Household Char. * d (female adult=1)*				
Household head's education (0,1) * d	0.788	0.598	0.665	0.538
	(3.26)**	(2.81)**	(2.23)*	(1.95)
Female headed household (0,1) * d	1.613	1.181	1.066	1.196
	(3.97)**	(3.28)**	(2.41)*	(2.85)**
Female headed, but married (0,1) * d	1.742	1.354	0.903	1.402
	(3.77)**	(3.14)**	(1.57)	(2.04)*
Land owned (ha) * d	0.080	0.077	-0.002	-0.010
	(1.20)	(1.28)	(0.06)	(0.32)
Value of big animals ('000birr) * d	0.000	-0.005	0.011	-0.004
	(0.00)	(0.13)	(0.21)	(0.08)
Value of chickens (birr) * d	0.005	0.004	0.000	0.000
	(2.53)*	(2.24)*	(0.07)	(0.09)
Muslim (0,1) * d	-1.589	-1.225	-0.772	-0.584
	(7.13)**	(6.11)**	(2.98)**	(2.47)*
Protest (0,1) * d	-0.681	-0.621	-0.357	-0.152
	(2.22)*	(2.25)*	(0.92)	(0.41)
Wald test: Food Aid * d	10.1 [0.01]**	5.69 [0.06]	4.82 [0.09]	5.80 [0.06]
Child Composition * d	11.6 [0.02]*	13.9 [0.01]**	13.9 [0.01]**	10.8 [0.03]*
Demographics * d	19.4 [0.00]**	13.5 [0.04]*	28.1 [0.00]**	10.9 [0.09]
Household char. * d	37.6 [0.00]**	28.2 [0.00]**	9.60 [0.14]	12.0 [0.06]
Log Likelihood	-1389	-707.4	-1091	-551.8
Number of individuals	2638	2638	2269	2269
(Households)	875	875	789	789

Note: Absolute value of z-statistics are in parentheses. P-values are in brackets. * indicates significant at 5% level; ** indicates significant at 1% level. A) Logits also include demographic, household characteristics variables, and wereda dummies.

Chapter 4

Food Aid's Effects on Crop Marketing in Rural Ethiopia

Abstract

Food aid's potential negative price effects have been major concerns in the literature and on the ground among those distributing it. When food aid is provided directly to households, the only way that food aid can have price effects is when it affects recipient households' crop marketing (including the crops received as food aid). By using instrumental variable models, we estimate food aid's effects on crop sales and purchases in rural Ethiopia. The results indicate that receiving cereals (mainly wheat) from food for work has negative effect on wheat purchases. Thus using wheat as payments at food for work projects may discourage local wheat production by decreasing wheat purchases and market prices. Alternative crops or cash could be used in areas where wheat production is important. Both theoretical and empirical results suggest that better food aid targeting to poor households will reduce effects on crop marketing because poor households are most likely to have high marginal propensity to consume food crops and low opportunity costs of labor.

4.1. Introduction

The literature on food aid focused heavily on (dis)incentive effects for twenty or so

years following the Cochrane (1959) – Schultz (1960) debates over PL480 (Barrett, 1999). Isenman and Singer (1977) summerize the disincentive argument as follows: an increase in food supplies provided by food aid shifts the supply curve and depresses prices received by farmers (price effects). In addition, it is sometimes argued that food aid may contribute policies that neglect agriculture.[25] By contrast, Sen (1960) claimed that the income effects of food aid mitigated price disincentives because increases in income generated by food aid would increase the demand for food which would partially diminish the negative impacts on prices caused by the supply side. More than a decade later, the evidence seemed to indicate that this was the case in India: disincentive effects of food aid on agricultural production had been small partially due to high income effects created by food aid (Isenman and Singer, 1977; Maxwell and Singer, 1979; Barrett, 1999).

In Ethiopia, one of the major food aid recipient countries in the past several decades,[26] food aid is provided to households directly through two schemes: free distribution (FD) and food for work (FFW). FD programs provide cereals (wheat, maize,

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[25] Isenman and Singer (1977) argued that one of the most important ways by which food aid have created significant disincentive effects on agriculture was that it relieved pressure on governments to aggressively invest in their domestic agriculture sector. For example, they suggested food aid supported and facilitated import-substitution industry policies in India, primarily by enabling the government to maintain large subsidized food distribution programs, while not adequately addressing some basic questions of food grain production and distribution.

[26] Ethiopia received 200,000 metric tons to about 1.2 million metric tons of food aid or between 3.5 and 26 percent as a proportion of total domestic food grain production over the 1985-96 period (Clay, Molla, and Habtewold, 1999). In the late 1980s, Ethiopia was receiving roughly 25 percent of all food aid delivered to Africa, and as late as 1998 was still receiving 22.5 percent. These statistics are from the World Food Program's (WFP) website at http:\\www.wfp.org.

and sorghum) and cooking oil to targeted households, while FFW projects provide employment opportunities with payments in-kind (cereals and cooking oil). Because food aid is provided directly to households, the only way that food aid can have negative price effects is through altering household behavior: either recipient households sell more food crops, including the crops received as food aid, in markets (the supply curve shifts outward) or buy less food crops from markets (the demand curve shifts inward). To investigate food aid's potential price effects, we need to examine how food aid affects recipient households' crop marketing.

Although there are studies on food aid's effects on famine mitigation and prevention (von Braun, Teklu, and Webb, 1998) and on labor supply at individual and household levels (Datt and Ravallion, 1994; on food subsidies Sahn and Alderman, 1996), previous studies of food aid's effects on crop marketing are limited. For instance, Webb, von Braun, and Yohannes (1992, section 7) review studies on FFW and find that in-kind payments from FFW were mainly consumed by households but were also sold to buy other goods, and that households made fewer purchases when they participate in FFW.

The purpose of this chapter, therefore, is to estimate effects of food aid on crop marketing at household level in rural Ethiopia. We use rural household survey data collected in 1996 based on a nationally representative sample frame. The results from this chapter will help food aid recipient governments and donors to understand how food aid may affect food crop prices and to mitigate potential adverse price effects, if there exist any. We use household models to examine the effects of food aid on crop marketing. The models predict that the effects of FD on crop marketing will be relatively small if food aid

is given to poor households whose marginal propensity to consume food is high.[27] The models also predict that the effects of FFW on crop marketing depend on the size of *net* income gain. If household labor is reallocated from other off-farm or crop production activities to FFW, then their *net* income gain will be smaller than the value of in-kind payments from FFW. As a result, households' food consumption does not increase as much under FFW as the amount of in-kind payments.[28]

To examine the effects of food aid on crop marketing, we estimate gross sales and purchase of wheat and other cereals (maize, sorghum, millet, and barley) in rural Ethiopia. We separate wheat from other cereals because wheat is used as a dominant food aid crop and expect to find different effects of food aid on wheat than other cereals. First, by estimating Heckman's two-step models, we test whether self-selection biases exist when we estimate gross sales and purchase models by using households with positive dependent variables only. The results do not indicate any significant self-selection bias. Second, based on these results, we estimate instrumental variable (IV) models among households with positive sales and purchase of wheat as well as other cereals. The results indicate that

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[27] Jayne, Strauss, Yamano, and Molla (2000) examined the degree of which food aid is targeted according to pre-aid per capita income at both regional and household level in rural Ethiopia. They found significant inverse associations between the pre-aid per capita income and the probability of receiving food aid both at regional and household level. However, they also found that high-income households still had a relatively high probability of receiving FD and participating in FFW.

[28] The importance of opportunity costs with workfare programs, and other issues related with targeting are summarized in Besley and Kanbur (1993). Datt and Ravallion (1994), for example, estimated the effects of participating in the Employment Guarantee Scheme (EGS) in India on other labor time allocations. They found that participating in EGS replaced mainly unemployment time, indicating small opportunity costs and large net income gain.

receiving cereals (mainly wheat) from FFW decreases purchase of wheat but has no effect on purchase of other cereals.

This chapter is organized as follows: Section 4.2 presents the data used in this chapter. Section 4.3 presents theoretical analysis of food aid's effects on crop marketing. Section 4.4 discusses our estimation strategies and describes variables used. Results are in section 4.5, followed by conclusions in section 4.6.

4.2. Data

The data come from the 1996 Food Security Survey (FSS), fielded on a subset of Agricultural Sample Survey (ASS) households in 1996 by the Central Statistics Authority (CSA) and the Grain Marketing Research Project in Ethiopia. In addition, monthly rainfall data were taken from 40 rainfall stations distributed throughout Ethiopia and matched to the locations of the household samples. The ASS used the same frame of enumeration areas (EAs) as used to conduct the 1994 Population Census. The ASS randomly selected 25 households in each sampled EA. Out of the 25 sampled households in each EA, 12 households were selected to be in the Economic and Social Welfare Monitoring Survey (ESWMS) funded by the World Bank. The ESWMS asked distances to various infrastructure such as bus stations. Out of the 12 households in each EA, 7 were randomly sampled to be in the Food Security Survey (FSS). The Food Security Survey collected detailed information regarding crop marketing and amounts of food aid received by each household, plus other information. Regarding crop marketing, the name of commodity and the quantities of sales and purchase in local units were recorded for each transaction. The

quantities in local units were converted into an universal unit, kg, by using conversion factors. Because of missing conversion factors, we had to drop 213 households, leaving us 3,899 households.

The survey asked whether at least one household member participated in food aid programs. If yes, the type of food aid program, FD or FFW, and the type of commodity provided were recorded. Furthermore, the quantity of commodity received was asked for each month between June 1995 through May 1996. The quantities received were converted into kg by using the same conversion factors used for crop marketing.

To show food crop production and food aid distribution by region, we present the mean kilograms of production, sales, purchase of wheat and other cereals (maize, sorghum, millet, and barely), and the mean kilograms of cereals received as food aid in Table 4.1 As one can see in the last column, households in Tigray and Amhara received a significant amount of food aid in 1995/96. Households in Tigray purchased 65 kilograms of wheat on average, which is significantly larger than the amount of wheat sales in Tigray. In Amhara, the amount of wheat purchase on average, 15 kilograms, also exceeds the amount of sales. These numbers suggest that Tigray and Amhara are not self-sufficient in wheat; additional wheat has to be imported to and sold in Tigray and Amhara either from other wheat production areas or from food aid. The numbers in Table 4.1, however, are not weighted and do not represent average sales and purchase accurately.

Table 4.1. Crop Marketing by Region (Oct 1995 - June 1996)

	Wheat			Other Cereals[A]			Food Aid[B]
Killil	Production	Sales	Purchase	Production	Sales	Purchase	
	— mean kilograms per household (standard deviations) —						
Tigray	87	27	65	429	175	183	75
	(275)	(189)	(360)	(745)	(489)	(506)	(100)
Amhara	63	8	15	500	80	75	30
	(156)	(41)	(90)	(587)	(181)	(219)	(73)
Oromiya	105	21	11	555	79	92	7
	(299)	(90)	(84)	(698)	(203)	(175)	(32)
Southern	36	15	15	280	53	71	9
(SNNPR/SEPA)	(156)	(90)	(105)	(660)	(249)	(202)	(34)
Others	101	18	15	499	49	106	12
	(285)	(76)	(43)	(836)	(148)	(205)	(41)
Total	76	16	16	461	75	89	17
	(235)	(87)	(118)	(688)	(229)	(225)	(54)

Note: A) Other cereals include maize, sorghum, millet, and barely. B) The numbers in this column are the mean kilograms of cereals provided as food aid. Wheat, maize, and sorghum were used as food aid cereals. Wheat's shares in kilograms are 66 percent and 57 percent in FD and FFW, respectively.

To present relationships between cereal marketing and the amount of cereals received as food aid, we show tabulations in Table 4.2. The last column shows the numbers of households who did not receive food aid at all (3,168); who received food aid from FD but did not participate in FFW (414); who participated in FFW but did not receive FD (236); and who received food aid from both FD and FFW (120).

In general, households who received food aid have lower sales and higher purchases than households who did not receive food aid at all; although, the differences may not be statistically significant because of large standard deviations. Differences between the four groups are significant in sales of other cereals. Households who participated in

Table 4.2. Crop Marketing by Households with and without Food Aid (Oct1995-June1996)

	Wheat		Other Cereals[A]		Food Aid[B]	Number of households
	Sales	Purchase	Sales	Purchase		
Households	-------- Mean kilograms per household (s.d.) --------					- number -
without any food aid	16.9 (90.7)	13.8 (99.9)	81.7 (239)	82.9 (202)	0	3,168
with FD	12.9 (73.4)	26.5 (208)	47.7 (199)	86.9 (231)	89.4 (131)	414
with FFW	15.5 (62.2)	30.4 (138)	37.0 (109)	143 (340)	91.4 (96.0)	236
with both FD and FFW	10.5 (51.8)	15.6 (47.1)	58.8 (217)	135 (393)	124 (104)	120
All Households	16.2 (86.6)	16.2 (118)	74.7 (229)	88.5 (225)	18.6 (64.3)	3,938

Note: A) Other cereals include maize, sorghum, millet, and barley. B) The numbers in this column are the mean kilograms of cereals provided as food aid. Wheat, maize, and sorghum were used as food aid cereals. Wheat's shares in kilograms are 66 percent and 57 percent in FD and FFW, respectively.

FFW but not in FD have the lowest amount of sales of other cereals, which is less than half of sales made by households who did not receive food aid. In purchases, households who participated in FFW have the highest amount of wheat purchase. They also have the highest amount of purchase of other cereals. These differences in sales and purchases between the four groups could be generated either by food aid targeting or by receiving food aid. The numbers in Table 4.2 are nothing but bivariate associations between crop marketing and food aid. To investigate further about the causal effects of food aid on crop marketing, we need to examine problems with theoretical models and estimate crop marketing with appropriate estimation models. In the next section we discuss the effects of food aid on crop marketing with household models.

4.3. Conceptual Framework

The most distinct feature of food aid from other income transfer programs is that recipients are food crop producers as well as consumers. Much of concerns about food aid's effects, such as price and policy effects, would not exist if recipients were not food crop producers. For instance, lower food prices improve households' welfare when households are net food crop buyers. Nevertheless, if improving agricultural productivity is a major concern for a recipient country, food aid's potential negative price effects should be examined. Lower output prices due to food aid may impede input use and production of households who grow certain cereals to sell.

Concerns over food aid's potential negative price effects become more or less important depending on how well markets function, or in other words whether the separability assumption between household production and consumption holds (Singh, Squire, and Strauss, 1986). For instance, consider a strict form of autarky household with wheat production (a non-separable model). If food aid in wheat is given to this household, then the household will allocate less resources to wheat production and more resources to other productions to maximize its utility level; the household has to consume what is given. However, if markets are complete (a separable model), in which all prices are constant, the household will not change — in a static model — its resource allocations in wheat production no matter how much of wheat is given; the household simply tries to maximize its profits and sells what is given if the available level of wheat exceeds its consumption level.

To examine food aid's effects on crop marketing, we consider a static household

model with and without the separability assumption. Results from this model should be considered as short-run effects. By following Strauss (1984), we define the net sales of crop j of household i as $NS_{ji} = X^{p}_{ji} - X^{c}_{ji}$, where X^{p}_{ji} is production of crop j and X^{c}_{ji} is consumption of crop j. The household utility function is assumed as a function of consumption of all K crops (X^{c}_{ji}) and leisure (l_i):

$$U(X^{c}_{1i}, \ldots, X^{c}_{ji}, \ldots, X^{c}_{Ki}, l_i) \tag{4.1}$$

Usual assumptions are applied, $U'_{Xcji}>0$, $U'_{li}>0$, $U''_{Xcji}<0$, $U''_{li}<0$, and $U'_{Xcji}{}'_{li}<0$.

In food for work programs, households with lower opportunity costs of labor are expected to participate in FFW more than households with higher opportunity costs of labor (self-selection). To examine the effects of participating in FFW, it is important to assume different wage rates to different households. To do so, we need to assume that family and hired farm labor have different wage rates (the imperfect substitution). Under this and other assumptions, the budget constraint can be written as:

$$\Sigma\, p_j X^{c}_{ji} = \Sigma\, p_j X^{P}_{ji}(L^{F}_{i}, L^{H}_{i}; \alpha_i) + z_i + w_i L^{O}_{i} + w^{H} L^{H}_{i}$$

$$L^{T}_{i} = L^{F}_{i} + L^{O}_{i} + l_i$$

L^{F}_{i} is the family farm labor supply; L^{H}_{i} is the hired labor; L^{O}_{i} is the off-farm labor supply; L_T is the total time available; p_i is the price of crop i; w_i is the wage rate for family labor; w^{H} is the wage rate for hired farm labor; and z_i is non-labor income. Maximizing income gives us the farm production function as a function of prices and wage rates. Thus we can define the full income Y_i as:

$$Y_i = \Sigma\, p_j X^{P}_{ji}(P, w^{H}, w_i; \alpha_i) + z_i + w_i L_T, \tag{4.2}$$

where P is a vector of all crop prices. Maximizing utility with respect to the budget

constraint gives us the demand for crops and leisure as functions of prices and the full income: $X^c_{ji} = X^c_{ji}(P,w^H,w_i,Y_i)$ and $l_i = l_i(P,w^H,w_i,Y_i)$. Therefore the net sales of crop j can be written as

$$NS_{ji} = X^P_{ji}(P,w^H,w_i;\ \alpha_i) - X^c_{ji}(P,w^H,w_i,Y_i)\ . \qquad (4.3)$$

We use these settings to analyze the effects of FD and FFW on crop marketing.

To examine the effects of food aid, we consider a change in net sales with and without food aid. We focus on a discrete change in food aid from zero to some amount instead of continuous change because we are interested in changes in crop marketing when food aid is provided to previously non-recipient households. Our interest is motivated by food aid targeting which asks who should receive food aid or participate in food aid programs. Before we discuss the effects of food aid on crop marketing in details, we present main results in Table 4.3. In general, food aid has positive effects on net sales of crop K, which is used as food aid, and negative effects on net sales of other crops. (Positive effects on net sales indicate more sales and less purchase, while negative effects indicate less sales and more purchase.) However, the sizes of effects are different depending on who receives FD or who participates in FFW. We discuss the effects of FD first.

The Effects of FD

Suppose free distribution (FD) programs provide a crop, say crop K, which is wheat in practice, to households directly. Receiving food aid from FD increases recipient households' income by the value of food aid, $p_K Q_{Ki}$. Q_{Ki} is the quantity of food aid given in

Table 4.3. Food Aid's Effects on Net Sales of Wheat and Other Cereals.

	Free Distribution	Food For Work		
		$w_i < p_K q_K$	$w_i = p_K q_K$	$w_i > p_K q_K$
	(1)	(2)	(3)	(4)
Wheat (crop K)	$Q_K - \Delta X^C_K > 0$	$q_K H + \Delta X^P_K - \Delta X^C_K > 0$	$q_K H > 0$	not participate
Other cereals (crop i ≠ K)	$-\Delta X^C_i < 0$	$\Delta X^P_i - \Delta X^C_i < 0$	no effect	not participate
Size of effect	depends on MPC	depends on net income gains and MPC		

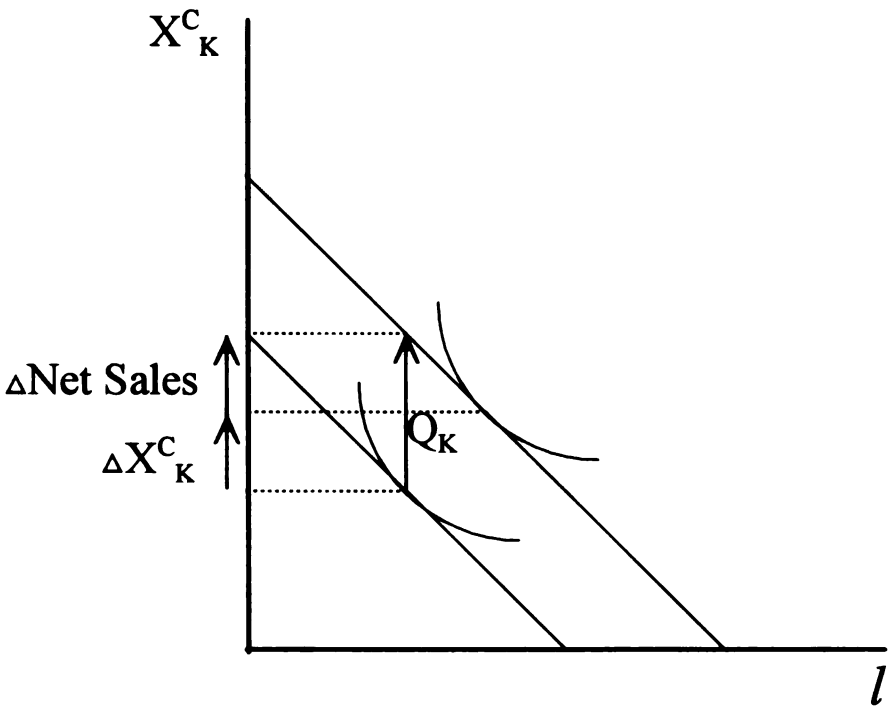
Note: Q_K is the quantity of crop K received as food aid; ΔX^C_i is the changes in consumption of crop i after receiving food aid; ΔX^P_i is the changes in production of crop i after receiving food aid; and $q_K H$ is the amount of crop K received as payments from FFW.

crop K to household i. Because the crop K is tradable, we need to redefine the net sales of crop K as $NS_{Ki} = Q_{Ki} + X^p_{Ki} - X^c_{Ki}$. We also denote the full income, the net sales of crop K, consumption of crop K, and leisure *without* food aid as Y_{i0}, NS_{Ki0}, X^c_{Ki0}, and l_{i0} and *with* food aid as Y_{i1}, NS_{Ki1}, X^c_{Ki1}, and l_{i1}. Under the separability and static assumptions, a crop production is not a function of income; therefore, receiving food aid from FD does not have any effects on production level. The change in net sales of crop K with and without FD is

$$\Delta NS_{Ki} = NS_{Ki1} - NS_{Ki0} = Q_{Ki} - [X^c_{Ki1}(P, w^H, w_i, Y_{i1}) - X^c_{Ki0}(P, w^H, w_i, Y_{i0})]. \quad (4.4)$$

The first term in this equation is the amount of crop K provided from FD. The inside of the bracket represents increases in consumption when income is increased by the value of food aid, $p_K Q_{Ki}$. The size of the increases in consumption depends on the marginal propensity to consume crop K (MPC_K). As MPC_K becomes larger, the inside of bracket becomes larger and the change in net sales as a whole becomes smaller. The difference

Figure 4.1. The Effects of Free Distribution



between the amount of food aid received, Q_{Ki}, and the increases in food consumption will be additional sales to the markets or reduced purchases that would have otherwise been made. This situation is illustrated in Figure 4.1. Food aid shifts the budget line upward by its value, Q_{Ki}, which is normalized by p. However, the consumption level of crop K does not increase as much as the value of food aid. If a recipient household is a net seller, then the household sells more by ΔNS_{Ki}. If a recipient household is a net buyer, then the household buys less by ΔNS_{Ki}.

Receiving crop K from FD has effects on net sales of other crops. The change in net sales of other crops ($j \neq K$) with and without FD is

$$\Delta NS_{ji} = NS_{ji1} - NS_{ji0} = - [X^c_{ji1}(P,w^H,w_i,Y_{i1}) - X^c_{ji0}(P,w^H,w_i,Y_{i0})] . \quad (4.5)$$

The only difference between equation (4.4) and (4.5) is that equation (4.5) does not have the amount of food aid, Q_{Ki}. Because the inside of bracket is positive as long as crop j is a normal good, the change in net sales of other crops will be negative; receiving food aid in crop K decreases sales or increases purchase of crop j.

The Effects of FFW

To investigate the effects of FFW, we consider utility maximization with and without participating in FFW. We denote the in-kind payment in crop K from FFW as q_K (quantity such as kilograms) and the time spent at FFW as H_i. A household participates in FFW when the utility level with participating in FFW is higher than the utility level without participating in FFW. For simplicity, we assume there is no constraint on the length of time to participate in FFW. As a result of this assumption, a household does not mix other

off-farm employments and FFW. We also need to redefine the net sales of crop K because the payment from FFW is in-kind (crop K): $NS_{Ki} = q_K H_i + X^p_{Ki} - X^c_{Ki}$. Unlike receiving food aid from FD, FFW has effects on farm production through wage rates. For further investigation we need to consider the effects of participating in FFW for three different types of households whose off-farm wage rate, w_i, is equal to, higher than, and less than the payment from FFW.

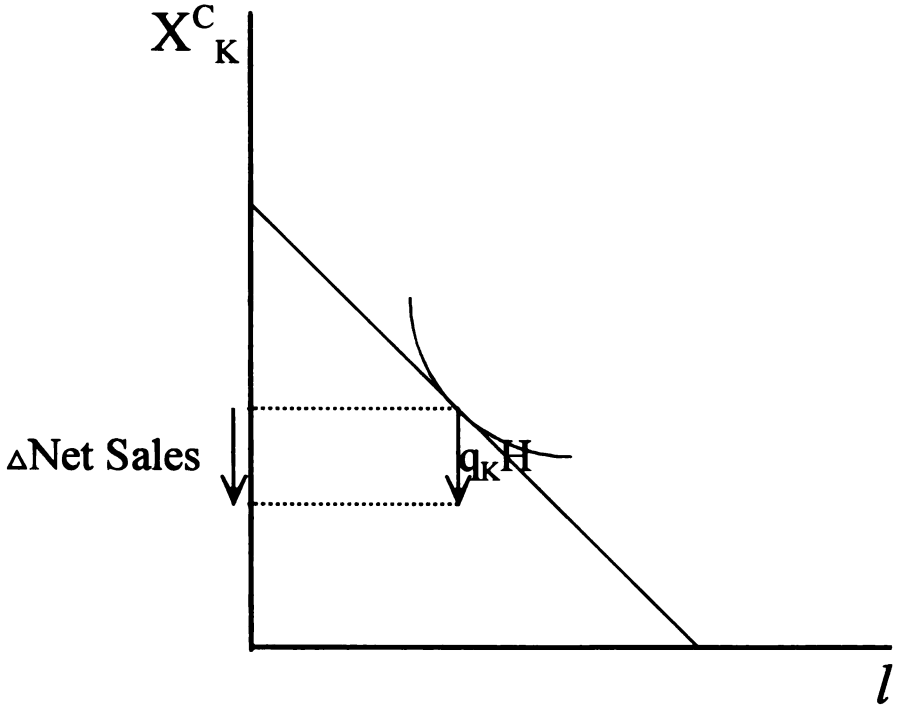
First, we consider the effect of food aid on crop marketing for households whose opportunity costs of family labor is equal to the payment from FFW, $p_K q_K = w_i$ (column 2 of Table 4.3). In this case, a household is indifferent between off-farm employments and FFW. A household's net income gain is zero by switching from other employment to FFW. The consumption and production level do not change. This result is easier to understand if we consider the net *purchase* instead of the net sales. The changes in the net purchase is

$$- \Delta NS_{Ki} = - (NS_{Ki1} - NS_{Ki0}) = - q_K H_i . \qquad (4.8)$$

The result indicates that a household who participates in FFW simply reduces its purchase of crop K by the amount of payments from FFW. On the other hand, it is difficult to justify why a household participates in FFW when the household is already selling crop K and the payment from FFW is equal to the wage rate. Figure 4.2 illustrates this situation. Because the payment from FFW and wage rate are the same, the consumption level does not change by participating in FFW. A participant household receives crop K by $q_K H_i$, which is

Figure 4.2. The Effects of Food For Work

When the payment from FFW is equal to the wage rate, q =w



the change in net sales. In this case, the net sales of other crops ($j \neq K$) does not change at all because there are no income or substitution effects.

Second, if the opportunity costs of family labor is lower than the payment from FFW, $p_K q_K > w_i$, then the household will participate in FFW (column 1 of Table 4.3). The difference in net sales of crop K with and without participating in FFW is

$$\Delta NS_{Ki} = NS_{Ki1} - NS_{Ki0} = q_K H_i + [X^P_{Ki1}(p_K q_K, p_K q_K; \alpha_i) - X^P_{Ki0}(p_K q_K, w_i; \alpha_i)]$$
$$- [X^c_{Ki1}(P, p_K q, Y_{i1}) - X^c_{Ki0}(P, w, Y_{i0})] . \quad (4.9)$$

A higher wage rate from FFW increases costs of hired labor and attracts family labor away from own farm production. Therefore, production level of crop K is lower in this case: inside of the first bracket is negative. And because the full income is higher and leisure is more expensive, both income and substitution effects increase consumption of crop K. Thus the inside of the second bracket is positive. Therefore, the difference in net sales of crop K between with and without participating in FFW, ΔNS_{Ki}, is positive as long as other crops and leisure are normal goods. But the size of change in net sales will be smaller than the change in net sales when the payment from FFW is equal to the wage rate. The difference in net sales of other crops ($j \neq K$) with and without participating in FFW is very similar to the equation (4.9) but without the amount of crop K received from FFW. Because the inside of the first bracket is negative and the inside of the second bracket is positive, the change in net sales of other crops will be negative.

Third, if the opportunity cost of family labor is higher than the payment from FFW, $p_K q_K < w_i$, the household participate in FFW (column 3 of Table 4.3). In sum, receiving food aid decreases net sales of crop K (mainly wheat in practices) and increases net sales

of other crops (Table 4.3). The magnitudes of food aid's effects depend on sizes of income and substitution effects on consumption of crop K and other crops. An implication from these results is that if food aid is targeted to or attracts poor households who have high marginal propensity to consume food crops and low opportunity costs, then the effects of food aid on crop marketing will be small. In next section we describe the estimation strategy and variables used in this chapter.

4.4. Estimations

4.4.1. The Estimation Strategy

In this sub-section we identify estimation models for crop marketing and discuss potential problems with estimations. In the previous section, we focused on net sales. Instead of estimating net sales directly, however, we decompose net sales into gross sales and purchase because estimating net sales itself will require a restriction that all coefficients to be the same when the net sales is positive and negative. This is a strong restriction. For instance, Goetz (1992) estimated sales and purchase separately by explaining households' failure to participate in markets with transaction costs which drove a wedge between sales and purchase prices.

The theoretical models in Section 4.2. provide a hypothesis that food aid has larger effects on net sales among households with high marginal propensity consume crops. In estimation, the relationship between food aid and sales (or purchase) in level, $\partial y_i/\partial q_i$, is partially determined by the transformation of dependent variables. For instance, if we estimate level-in-level models, we assume that the effect of food aid on sales (or purchase)

is constant over the entire sample, $\partial y_i/\partial q_i = \gamma_{Level}$. Or if we estimate semi-log models where dependent variables are in log, we assume that the effect of food aid on sales (or purchase) is a linear function of sales : $\partial y_i /\partial q_i = \gamma_{Semi\text{-}log}\, y_i$. Based on our discussion in the previous section, semi-log models would appear to be more appropriate.[29]

Because two dependent variables (sales and purchase) are censored at zero, estimating OLS over the entire sample may generate biased estimators. One way to eliminate the bias is to use Tobit models. However, by using Tobit we need to impose restrictions on coefficients to be the same among censored and uncensored sample. Another way to eliminate possible biases caused by censoring is to use self-selection models. A self-selection model may have the form:

$$\ln y^*_i = x_i \beta + e_i \qquad i = 1, ..., N \qquad (4.11)$$

$$d^*_i = z_i \eta + v_i \qquad i = 1, ..., N \qquad (4.12)$$

$$d_i = 1 \text{ if } d^*_i > 0 \,;\; d_i = 0 \text{ otherwise} \qquad (4.13)$$

$$\ln y_i = \ln y^*_i * d_i \qquad (4.14)$$

where $\ln y^*_i$ is the latent endogenous variable with observed counterpart $\ln y_i$; d^*_i is a latent variable with associated indicator function d_i whether the primary dependent variable, $\ln y^*_i$, is observed; x_i and z_i are vectors of exogenous variables; β and η are vectors

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[29] The Box-Cox transformation provides more general cases. Under the Box-Cox transformation the effects of food aid on sales (or purchase) in level is $\partial y_i/\partial q_i = \gamma_{Box\text{-}Cox}\, y_i^{1-\lambda}$. Therefore, we estimated λ for sales and purchase by using the Box-Cox transformation models. The results indicate that λ are significantly different from 0 (semi-log), but close to it: the estimated λ is 0.1439 for sales and 0.1065 for purchase. We estimated all the models in this chapter with the Box-Cox transformed y_i, yet we found the results are similar to semi-log models. Because of complications in interpretations and in fixing standard errors, we decided to use semi-log models instead of the Box-Cox transformed models.

of unknown parameters; and e_i and v_i are zero mean error terms with $E[e_i | v_i] \neq 0$. We denote the entire sample size with N and the sub-sample for which $d_i = 1$ with n. For our applications, the dependent variable $\ln y_i$ can be the gross sales or purchase of food crops.

We use Heckman's two-step estimation to test whether self-selection biases exist (Heckman, 1976; 1979). First we estimate the equation (13) with Probit by using the entire sample N and obtain the inverse Mills ratio, δ. Then we estimate the next equation with OLS,

$$\ln y_i = x_i \beta + \mu \delta_i + u_i \qquad i = 1, ..., n, \qquad (4.15)$$

One major concern, besides the distributional assumption, is the exclusion restriction that at least one variable of z_i dose not appear in x_i. Goetz (1992), for example, used high fixed transaction costs to justify his exclusion restrictions.[30] However, because it is often difficult to justify exclusion restrictions based on economic theory, many empirical researchers use the same variables for both Probit and OLS estimations and identify β through the nonlinearity in the inverse Mills ratio. We follow this practice. If we find the inverse Mills ratio significant in two-step models, then we include the inverse Mill ratio in IV models to control for self-selection. If the inverse Mills ratio is found insignificant, then we do not include the inverse Mills ratio in IV models and use households with positive

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[30] He excluded three transaction related variables (ownership of carts for transportation to market, physical distance from market, and a regional dummy variable) from the second stage. However, high fixed transaction costs may decrease *amounts* of sales and purchase in addition to *probabilities* of participating in markets. In early investigations, we found some variables related to transaction costs, such as distance to the nearest bus station, significant in the second stage by using our data. Thus we decided to include transaction costs related variables in the second stage. As a result, we lost one possible theoretical justification for the exclusion restriction.

dependent variables only. As instrumental variables, we use six interaction terms between wereda means of food aid received (from FD and FFW) and three household characteristics (land holdings, value of animal owned, and female headed dummies). All IV models are estimated with wereda dummy variables (wereda fixed effects). Before we present our results, we describe variables we used in our estimation models in next sub-section.

4.4.2. Variable Construction

Crop Marketing

As discussed previously, we use information on the amount of gross sales (kg) and purchase (kg) of wheat and other cereals between the last harvest (October - December of 1995) and the survey period (June 1996). Other cereals include maize, wheat, sorghum, millet, and barely. Total household gross sales and purchase of wheat and other cereals were used instead of per capita amount of sales and purchase.

Household Characteristics

We include four household demographic composition variables. The four variables are a fraction of children under 6-year-old, a fraction of boys aged between 7 and 14, a fraction of girls aged between 7 and 14, and a fraction of elderly over 50-year-old. We do not separate children under 6-year-old and elderly over 50 year-old by gender because we did not find any significant difference in estimated coefficients between genders in early investigations.

The only information on education is of household heads. Because most of household heads do not have education, we use a dummy variable which is one if the household heads have any education. Household heads' age is also included. A quadratic term of heads' age was included in early models but not in final models because it was found insignificant. We also include two dummy variables for female headed household: one for a female head who is currently unmarried and one for currently married. We need to distinguish them from unmarried female heads because married female heads may have remittance from their husbands or their husbands may come home during a busy season.

We have two variables that represent household wealth: the amount of land owned in hectare and the value of animals owned in birr. Based on some investigations we decided to use a spline function for land holdings, with a knot at two hectares, and a quadratic function for animal holdings. Predominant religion in Ethiopia is Orthodox Christianity, but there are substantial number of Muslim and Protestant households. Therefore we use dummy variables for Muslim and Protestant households. Other religions such as local or traditional religions are omitted with Orthodox Christianity.

Plot Level Shocks

We constructed three plot level shock variables based on information from the Agricultural Sample Survey. The information is on shocks during the 1995 Meher season. For each plot, households were asked whether a plot was damaged. If yes, the source of damage was asked. Three major sources were shortage of rain, flood, and crop disease/insect problems. Because we know the size of plots, we constructed three

variables that are fractions of area planted with one of these shocks. Two rainfall related variables, namely fractions of area planted with shortage of rain and flood, are expected to have small variation within a wereda because rainfall affects households within a wereda in similar way. On the other hand, the third shock variable, a fraction of area planted with crop disease/insect problems, is expected to be more idiosyncratic.

Regional Level Variables

By using household level purchase information between January and April, we constructed a wereda level food crop price. We chose purchase price over sales price because we have more information on purchase than sales and we found no significant difference between purchase and sales prices within a wereda during the same period. We chose a period between January and April over other periods, because more transactions, especially purchase, were made during this period.

On agro-climate variables, we have the elevation (in meters) and long-run rainfall during a growing season. Elevation readings were taken using the Global Positioning System, a satellite-based system to take such readings. Rainfall is a critical factor related to cereals production in Ethiopia because farming is rainfed (not irrigated). We use median Meher season planting rainfall (in millimeters) from 1988 through 1995.[31] These were derived by taking summing April through August rainfalls for these years from data collected by 40 rainfall stations of the Ethiopian National Meteorological Services

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[31] These years were chosen because earlier years had many missing observations for many stations.

Agency. Each sample zone (an area whose size is in between a wereda and a Killil) was matched up to the closest rainfall station, providing there was at least one in the area.[32] To investigate the effects of rainfall shocks on crop marketing, we constructed two rainfall shock variables by taking difference between rainfall in 1994 (or 1995) Meher season and the median rainfall between 1988 and 1995. Positive difference indicates more rainfall, therefore a good year in general, while negative difference indicates shortage.

The only variables we have on community level infrastructure are distance to the nearest bus station and types of roads. On road types, we use five dummy variables, road type 1 being the best conditioned road, followed by type 2, 3 and so forth.

4.5. Results

4.5.1. Market Position (Probit)

We estimate probabilities of sales and purchase of wheat and other cereals with Probit; the estimated coefficients in Table 4.4 and 4.5 are changes in marginal probability. Descriptive statistics of all variables are in appendix Table A4.1. We present results from models with *domain* and *wereda* dummies for each sales and purchase because both models have advantages and disadvantages. Domain is the second largest regional unit based on agro-ecological characteristics. There are 21 domains in Ethiopia. Wereda is relatively smaller regional units (akin to a county in the U.S.); there are 357 weredas in

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[32] As mentioned, the Afar area was the one that did not have a rainfall station close by (and the nearest did not have 1995 data). We consequently dropped that area, which only contains 86 households. All weredas within a killzone were assigned the same long-run median rainfall.

our data. The main advantage of models with domain dummies is that these models allow for wereda level variables, such as prices and rainfall, to be estimated. However, the estimated coefficients with domain dummies may be biased because of unobserved wereda characteristics. Thus, the models with wereda dummies (wereda fixed effects) are estimated to eliminate biases caused by unobserved wereda characteristics.

The results from Table 4.4 indicate that having educated household heads increases the probability of selling wheat by 5.1 percent and other cereals by 5.7 percent. The probabilities of selling wheat and other cereals increase as the size of land holdings increases up to 2 hectares but gradually declines over 2 hectares. Rainfall related variables, such as plot level shocks and rainfall shocks, are also significant. When we estimated models with domain dummies, fraction of plot areas with shortage of rain has significantly negative effects on probabilities of selling wheat and other cereals. Yet, the estimated coefficient of plot level shocks with shortage of rain becomes insignificant as we include wereda level dummies. This is as expected because households within the same wereda face similar rainfall shocks.

The probability of selling wheat is more sensitive to regional level rainfall than other cereals. The average rainfall and rainfall shocks in 1995 have significant effects on the probability of selling wheat but not on the probability of selling other cereals. The average rainfall has negative effects on selling wheat, indicating that households who live in areas with lower average rainfall have higher probability of selling wheat. On the other hand, the positive rainfall shocks in 1995 increases the probability of selling wheat.

Unmarried female headed households have significantly lower probability (10.5

percent) of selling other cereals than male headed households. Married female headed households display no significant differences from male headed households in sales and purchase. These results may indicate that married female headed households get help in farming or in remittance from male members, who are typically absent for most of the year.

On purchase in Table 4.5, the results indicate that households with lower production level have higher probabilities of purchasing wheat and other cereals. It is not the other way around that high (agricultural) income households have higher probabilities of purchasing wheat and other cereals. For instance, both married and unmarried female headed households have higher probabilities of purchasing wheat and other cereals; all plot level negative shocks increase the probabilities of purchasing wheat and other cereals; households with smaller animal and land holdings have lower probabilities of purchasing wheat and other cereals.

4.5.2. Self-Selection (Heckman's Two-Step)

To test whether there exist self-selection biases when we estimate the log of amount (kilograms) of sales and purchase of wheat and other cereals with truncated OLS, we estimate Heckman's two-step models. Even though Heckman's two-step model requires an exclusion of at least one variable from the second stage as we discussed in Section 4.3.1, we use the same variables in both first and second stages, relying on nonlinearity in the inverse Mills ratio. The results are in appendix. The results in Table A4.2 and A4.3 indicate no significant self-selection bias: all four inverse Mills ratios are

insignificant. To compare the results with and without controlling for self-selection, we present results from Heckman's two-steps and OLS models. Based on these results, we estimate sales and purchase models using only households with positive dependent variables without controlling for self-selection.

4.5.3. The Effects of Food Aid

To estimate food aid's effects on the sales and purchase of wheat and other cereals, we estimate instrumental variable (IV) models. Instruments used are twelve interaction terms between two wereda level mean kilograms of cereals received from food aid (FD and FFW) and four household level variables (land holdings, animal holdings, female headed dummy, and fraction of plot areas with shortage of rain).[33] To obtain robust results in the choices of IVs, we estimated the same models with different sets of instruments. A summary of results are presented in Table 4.8. The Hausman statistics for exogeneity of two food aid variables (k=2) and the F statistics of these instruments in first stages are reported in Table 4.6, 4.7, and 4.8 along with estimated coefficients in second stages.

On Sales

The results in Table 4.6 indicate that receiving cereals from FD does not have

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[33] We have two variables for each land and animal holdings because land holdings is splined with a knot at 2 hectares and animal holdings is squared. Thus we have six household level variables. Interacting these six household variables with two wereda means of food aid received gives us twelve interaction terms for IVs.

significant effects on sales of other cereals. The estimated coefficient of FD with OLS (column 1) is negative and significant, which indicates that households with FD has statistically smaller amount of wheat sales. This result is consistent with what we saw in Table 4.2. However, when food aid variables are instrumented (column 2), the estimated coefficient of FD becomes smaller and insignificant. As one can see in Table 4.8, sizes of estimated coefficients of FD on wheat sales with different sets of instruments are sensitive to the choices, ranging from -0.018 to -0.061. Thus although it seems that FD has negative effects on wheat sales (possible by discouraging wheat production), it is difficult to determine the effects of FD on wheat sales.

Receiving cereals from FD does not have any significant effects on sales of other cereals (column 4 in Table 4.6). Yet, the results may depend on the definition of "other cereals" (maize, sorghum, millet, and barely). We may find different results if we estimate sales and purchases of maize and sorghum only because maize and sorghum are used as food aid cereals as well. We present estimation results on maize and sorghum in appendix (Table A4.5). In Table A4.5, the dependent variables are the sum of maize and sorghum sold and purchased. The results do not indicate any significant effects of food aid on sales and purchase of maize and sorghum. Thus the results seem to be robust to definitions of other cereals.

On Purchase

The results in Table 4.7 indicate that receiving cereals from FFW decreases purchase of wheat and has no significant effect on purchase of other cereals. The negative

effect of FFW on wheat purchase is as predicted by theoretical models (Table 4.3). The estimated coefficient of FFW on purchase of wheat with IV in column 2 in Table 4.7 is significant and negative. This result is robust to choices of instruments; the results under three alternative sets of instruments indicate very similar results, estimated coefficients ranging from -0.041 to -0.051 (Table 4.8). The magnitude of the estimated coefficient indicates that receiving 10 kilograms of cereals from FFW decreases wheat purchase by 4.6 percent. Because the estimation models are in semi-log, the size of estimated effects increases as the amount of wheat purchase increases. The effects of receiving 10 kilograms of cereals from FFW on purchase of wheat can be written as:

$$\partial(\text{wheat purchase in kgs}) / \partial(\text{FFW 10 kgs}) = 0.046 * \text{wheat purchase in kgs.}$$

Thus, receiving 10 kilograms of wheat from FFW decreases purchase of wheat by 1.4 and 2.3 kilograms for households with 30 and 50 kilograms of wheat purchase.

The estimated coefficient of FFW on purchase of other cereals with OLS (column 3) is positive, indicating that households who participated in FFW have larger purchase of other cereals than households who did not. This result could be caused either by self-targeting or by receiving food aid from FFW. Yet, the estimated coefficient of FFW with IV is negative and insignificant, indicating that the result in column 3 is caused by self-targeting. In contrast, receiving cereals from FD does not have any significant effects on purchases of wheat and other cereals.

On Teff

Teff is one of the high value crops that are consumed widely and has different

commodity characteristics than other cereals. To see whether food aid has effects on high value crops more than low value crops, such as those included in the "other crops," we estimate the models on sales and purchase of teff. The results in appendix Table A4.6 indicate a similar effect of FD on wheat: receiving cereals from FD decreases sales of teff. Both wheat and teff are high value crops. But we do not find any significant effects on purchase of teff.

Other Variables

Sales of wheat and other cereals increase as the size of land holdings increases up to 2 hectares. Having more than 2 hectares of land does not have significant effects on sales of wheat and other cereals. Having more animals increases sales of wheat and other cereals with decreasing rate. However, having more animals has opposite effects on purchase of what and other cereals. Having more animals increases purchase of wheat but decreases purchase of other cereals; thus, these results indicate that wheat is a luxury good, while other cereals are not. Household size increases the amount of sales and purchase of both wheat and other cereals. Fraction of boys aged between 7 and 14 has strong negative effects on wheat purchase but not on purchase of other cereals. This is difficult to interpret.

4.6. Conclusions

In this chapter, we have considered food aid's potential negative price effects. We used household models to examine the effects of food aid (free distribution and food for

work) on crop marketing. Our theoretical models underscore the importance of food aid targeting to poor households to mitigate potential negative price effects because poor households are most likely to have high marginal propensity to consume food crops and low opportunity costs of labor. To determine food aid's effects on crop marketing empirically, we estimated gross sales and purchases of wheat and other crops with instrumental variable (IV) models. Because the dependent variables were censored at zero, we tested whether self-selection biases exist when truncated models were estimated. The results from Heckman's two-step models did not indicate any significant self-selection bias. Therefore we estimated gross sales and purchases of wheat and other cereals by using households with positive dependent variables.

The results indicate that households decrease purchases of wheat when they participate in food for work. The size of impact increases as the amount of wheat purchases increases. Based on these empirical results we draw four policy implications. First, policy makers and food aid donors should recognize that different types of food aid programs have different effects on food crop marketing (and potentially on food crop prices). Food aid is used in various ways, such as monetization, free distribution, food for work, and food for school. According to the results in this chapter, the two major food aid programs used in rural Ethiopia — free distribution and food for work — have different effects on food crop marketing. Thus when policy makers discuss food aid's potential adverse effects on crop marketing, the types of food aid programs should be taken into account. Specially, the results show that providing wheat through food for work programs may depress local wheat prices through decreased wheat purchases and may discourage

local wheat production. By contrast, providing wheat through free distribution did not have significant effects. Therefore, in areas where many households produce and sell wheat, it may be a good idea to minimize the use of wheat in food for work programs. Further empirical analysis of food for work in other countries would be useful to test the robustness of these findings.

Second, the estimated magnitude of food for work's effects on wheat purchase increases as the amount of wheat purchases increases. By estimating semi-log models, we found that receiving 10 kilograms of cereals from food for work decreases wheat purchases by 4.6 percent (of the total amount of wheat purchase). Therefore it is advisable to take additional cautions in using wheat as payments at FFW programs in areas where wheat purchases are high.

Third, we did not find monetization of food aid at household level. It is sometimes considered that the potential disincentive effects would occur through household sales of the crops provided as food aid (i.e., monetization). The results did not indicate any positive effects of food aid on sales of wheat and other cereals.

Furth, however, the results of this chapter suggest that potential disincentive effects can (and do) occur through household purchase behavior. Examining food aid's effects on household sales side only may leads monitoring agents to conclude that food aid has no effects on crop prices on markets. Yet, food aid may depress crop prices through decreasing purchases and this is what we found in rural Ethiopia. Therefore, a major conclusion of this study is the needs to consider the effects of food aid on markets both from crop purchases as well as crop sales. The Bellman Amendment, Section 401 (b) of

the United States Government's Agricultural Development and Trade Act of 1990 (the Farm Bill), for instance, only consider food aid's effects on sales side but not purchase side.

The results discussed in this chapter should be treated as short-run effects of food aid. Food aid programs may have negative effects in the long-run by creating dependency and discouraging agricultural production (especially wheat production). On the other hand, food aid programs may have positive effects in the long-run. Food for work programs, especially, may have large positive impacts on crop sales in the long-run through improved local infrastructure constructed by food for work programs. We did not consider such long-run effects of food aid on crop marketing in this chapter. Even the short-run effects in this chapter may not be generalized because of Ethiopia's well established relief institutions (governments and non-governmental organizations) and a long history of food aid distribution. More empirical results from other countries that are comparable with the results in this chapter will be necessary before we establish solid evidence of food aid's effects on crop marketing and local crop prices.

Table 4.4. Marketing Participation — Sales (Probit ^)

	Wheat		Other Cereals	
		Wereda FE		Wereda FE
	(1)	(2)	(3)	(4)
Household Characteristics				
Household size	0.004	0.005	-0.001	-0.007
	(2.03)*	(0.62)	(0.13)	(1.08)
Head's education (1)	0.021	0.051	0.024	0.057
	(2.40)*	(1.69)	(1.22)	(2.30)*
Head's age	-0.001	-0.001	-0.001	-0.001
	(1.45)	(0.93)	(0.77)	(0.70)
Female headed (1)	0.001	-0.035	-0.070	-0.105
	(0.11)	(0.87)	(2.71)**	(3.27)**
Female headed, but head married (1)	0.001	0.038	-0.060	-0.050
	(0.06)	(0.55)	(1.65)	(1.11)
Fraction of children age under 6	-0.004	0.040	0.019	0.045
	(0.15)	(0.44)	(0.36)	(0.66)
Fraction of boys age between 7 and 14	0.013	0.039	0.015	0.047
	(0.42)	(0.37)	(0.23)	(0.56)
Fraction of girls age between 7 and 14	-0.081	-0.224	-0.106	-0.186
	(2.47)*	(2.04)*	(1.53)	(2.13)*
Fraction of elder age over 50	-0.017	-0.127	-0.117	-0.089
	(0.59)	(1.29)	(2.00)*	(1.23)
Land owned, splined at 2 ha	0.024	0.128	0.069	0.152
	(3.56)**	(4.63)**	(4.72)**	(7.091)**
Land owned, over 2 ha	-0.010	-0.016	-4.9*10-e4	-0.004
	(2.06)*	(1.26)	(0.16)	(1.61)
Value of animals ('000 birr)	0.008	0.038	0.044	0.069
	(1.49)	(1.76)	(2.67)**	(3.12)**
Value of animals ^ 2	0.000	-0.001	-0.005	-0.008
	(0.29)	(0.37)	(1.75)	(2.18)*
Muslim (1)	-0.033	-0.038	0.020	-0.048
	(3.26)**	(0.81)	(0.79)	(1.15)
Protestant (1)	-0.009	-0.063	-0.056	-0.051
	(0.67)	(1.51)	(2.00)*	(1.45)
Plot level shocks				
Fraction of plot areas with rain shortage	-0.063	-0.138	-0.143	-0.079
	(3.00)**	(1.74)	(3.53)**	(1.34)
Fraction of plot areas with flood	0.023	0.091	-0.123	-0.115
	(1.00)	(1.03)	(2.02)*	(1.34)
Fraction of plot areas with crop disease/	-0.075	-0.258	-0.063	-0.093
Insect problems	(2.81)**	(2.62)**	(1.40)	(1.54)
Regional level variables				
Price of food crops (birr/kg)	-0.022		0.047	
	(2.29)*		(2.36)*	
Elevation (mm) * 10e-2	0.001		-0.009	
	(1.24)		(4.34)**	
Average Rainfall (mm) * 10e-2	-0.011		0.013	
	(3.49)**		(1.88)	
Rainfall shocks in 1994 (mm) * 10e-2	-0.006		-0.005	
	(1.09)		(0.46)	
Rainfall shocks in 1995 (mm) * 10e-2	0.008		-0.003	
	(2.68)**		(0.59)	
Distance to Bus station (10km)	4.5*10e-4		0.001	
	(1.90)		(1.66)	
	Domain dummies	Wereda dummies	Domain dummies	Wereda dummies
Wald test : Value of animals	4.21 [0.12]	5.61 [0.06]	7.79 [0.02]*	10.4 [0.00]**
Plot level shocks	17.3 [0.00]**	9.83 [0.02]*	16.5 [0.00]**	5.32 [0.15]
Road Dummies [B]	10.3 [0.07]		26.3 [0.00]**	
Log Likelihood	-966.4	-614.4	-2260	-1669
Observations	3767	1425	3877	3254

Note: Absolute z-statistics are in parentheses. Numbers in brackets are p-values. * indicates significant at 5 % level; ** indicates significant at 1 % level. Five road dummies and included in models with domain dummies but not reported. A) Reported coefficients are changes in marginal probability. B) Estimated coefficients of road dummies are not reported.

Table 4.5. Marketing Participation — Purchase (Probit ^)

	Wheat		Other Cereals	
		Wereda FE		Wereda FE
	(1)	(2)	(3)	(4)
Household Characteristics				
Household size	-0.001	-0.004	0.004	0.008
	(0.31)	(0.64)	(0.85)	(1.37)
Head's education (1)	0.012	0.043	-0.021	-0.009
	(0.73)	(1.78)	(1.01)	(0.36)
Head's age	0.002	0.002	0.001	0.001
	(2.58)**	(2.40)*	(0.82)	(0.66)
Female headed (1)	0.030	0.058	0.059	0.099
	(1.58)	(1.80)	(2.21)*	(3.12)**
Female headed, but head married (1)	0.079	0.086	0.067	0.103
	(2.44)**	(1.86)	(1.75)	(2.27)*
Fraction of children age under 6	-0.021	-0.045	0.037	0.078
	(0.45)	(0.68)	(0.66)	(1.17)
Fraction of boys age between 7 and 14	-0.038	-0.114	0.134	0.142
	(0.68)	(1.43)	(1.95)	(1.73)
Fraction of girls age between 7 and 14	-0.007	-0.073	0.188	0.200
	(0.12)	(0.88)	(2.63)**	(2.34)*
Fraction of elder age over 50	-0.185	-0.268	-0.061	-0.038
	(3.73)**	(3.82)**	(1.02)	(0.54)
Land owned, splined at 2 ha	-0.039	-0.030	-0.076	-0.086
	(3.11)**	(1.44)	(4.99)**	(4.12)**
Land owned, over 2 ha	0.003	0.005	0.002	0.003
	(1.78)	(2.24)*	(1.04)	(1.06)
Value of animals ('000 birr)	-0.018	-0.017	-0.041	-0.051
	(1.50)	(0.96)	(2.93)**	(2.85)**
Value of animals ^ 2	0.001	0.001	0.002	0.004
	(0.84)	(0.64)	(1.27)	(1.85)
Muslim (1)	-0.088	-0.097	-0.059	0.014
	(4.28)**	(2.52)*	(2.19)*	(0.34)
Protestant (1)	-0.040	-0.088	-0.014	-0.053
	(1.73)	(2.34)*	(0.46)	(1.34)
Plot level shocks				
Fraction of plot areas with rain shortage	0.070	0.162	0.113	0.161
	(2.17)*	(2.92)**	(2.77)**	(2.71)**
Fraction of plot areas with flood	0.082	0.122	0.064	0.047
	(1.76)	(1.67)	(1.05)	(0.56)
Fraction of plot areas with crop disease/	0.080	0.066	0.094	0.096
Insect problems	(2.19)*	(1.18)	(2.00)*	(1.66)
Regional level variables				
Price of food crops (birr/kg)	0.090		-0.073	
	(5.29)**		(3.50)**	
Elevation (mm) * 10e-2	0.005		0.006	
	(2.93)**		(2.81)**	
Average Rainfall (mm) * 10e-2	-0.006		0.010	
	(1.03)		(1.42)	
Rainfall shocks in 1994 (mm) * 10e-2	0.018		-0.023	
	(1.79)		(1.92)	
Rainfall shocks in 1995 (mm) * 10e-2	0.023		-1.0*10e-4	
	(4.67)**		(0.02)	
Distance to Bus station (10km)	0.000		-0.002	
	(0.60)		(3.63)**	
	Domain dummies	Wereda dummies	Domain dummies	Wereda dummies
Wald test : Value of animals	2.48 [0.29]	0.94 [0.63]	11.0 [0.00]**	8.50 [0.01]*
Plot level shocks	10.7 [0.01]*	11.5 [0.01]**	11.2 [0.01]*	9.33 [0.03]*
Road Dummies [B]	17.0 [0.00]**		9.92 [0.08]	
Log Likelihood	-1844	-1392	-2547	-1970
Observations	3939	2890	3939	3520

Note: Absolute z-statistics are in parentheses. Numbers in brackets are p-values. * indicates significant at 5 % level; ** indicates significant at 1 % level. Five road dummies and included in models with domain dummies but not reported. A) Reported coefficients are changes in marginal probability. B) Estimated coefficients of road dummies are not reported.

Table 4.6. Food Aid's Effects on Sales

	Ln(Wheat Sales kgs)		Ln(Other-Cereal Sales kgs)	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
Food Aid				
FD cereals received (10kg) A	-0.038	-0.018	0.001	-0.006
	(2.14)*	(0.66)	(0.06)	(0.34)
FFW cereals received (10kg) A	-0.012	-0.005	0.002	-0.008
	(0.63)	(0.08)	(0.17)	(0.40)
Household Characteristics				
Household size	0.113	0.111	0.032	0.033
	(3.27)**	(3.21)**	(1.55)	(1.56)
Head's education (1)	-0.039	-0.032	0.219	0.216
	(0.26)	(0.21)	(2.72)**	(2.68)**
Head's age	-0.002	-0.002	0.001	0.001
	(0.30)	(0.26)	(0.17)	(0.18)
Female headed (1)	0.199	0.182	-0.012	-0.009
	(0.91)	(0.83)	(0.10)	(0.07)
Female headed, but head married (1)	0.303	0.312	-0.162	-0.166
	(0.88)	(0.90)	(0.98)	(1.00)
Fraction of children age under 6	0.282	0.222	0.098	0.086
	(0.58)	(0.45)	(0.43)	(0.38)
Fraction of boys age between 7 and 14	-0.594	-0.566	-0.047	-0.048
	(1.05)	(0.99)	(0.17)	(0.17)
Fraction of girls age between 7 and 14	-0.025	0.072	-0.017	-0.002
	(0.04)	(0.11)	(0.06)	(0.01)
Fraction of elder age over 50	0.118	0.103	-0.039	-0.052
	(0.22)	(0.19)	(0.15)	(0.20)
Land owned, splined at 2 ha	0.223	0.190	0.201	0.199
	(1.47)	(1.18)	(2.72)**	(2.67)**
Land owned, over 2 ha	0.047	0.051	-0.006	-0.006
	(0.42)	(0.45)	(0.65)	(0.65)
Value of animals ('000 birr)	0.286	0.290	0.151	0.147
	(2.83)**	(2.86)**	(2.06)*	(1.98)*
Value of animals ^ 2	-0.013	-0.014	-0.027	-0.026
	(2.13)*	(2.14)*	(2.32)*	(2.27)*
Muslim (1)	-0.478	-0.490	-0.064	-0.062
	(1.18)	(1.18)	(0.43)	(0.42)
Protestant (1)	0.308	0.310	-0.039	-0.038
	(0.96)	(0.92)	(0.28)	(0.28)
Plot level shocks				
Fraction of plot areas with rain shortage	0.899	0.655	0.214	0.235
	(1.71)	(1.13)	(1.02)	(1.07)
Fraction of plot areas with flood	0.709	0.713	-0.023	-0.017
	(1.45)	(1.44)	(0.07)	(0.05)
Fraction of plot areas with crop disease/	0.863	1.066	-0.196	-0.203
Insect problems	(1.11)	(1.30)	(0.90)	(0.92)
	Wereda dummeis		Wereda dummies	
Constant	4.485	4.274	1.550	1.554
	(3.95)**	(2.33)*	(1.55)	(1.55)
Hausman test on Food Aid (k=2)		1.08		0.43
F stat. for IVs in first stages : FD		16.0 [0.00]**		27.1 [0.00]**
FFW		2.37 [0.01]**		27.8 [0.00]**
F test : Value of animal owned	4.25 [0.02]*	4.34 [0.01]*	2.72 [0.07]	2.59 [0.08]
Plot level shocks	2.14 [0.10]	1.88 [0.13]	0.71 [0.55]	0.73 [0.53]
R-squared	0.68	0.68	0.54	0.54
Number of observations	357	357	1235	1235

Note: Absolute t-statistics are in parentheses. P-values are in brackets. * indicates significant at 5% level; ** indicates significant at 1% level. A) Endogenous variables; Instruments are 4 interaction terms between wereda mean food aid received in kg for FD and FFW and household characteristics (land holdings and female head dummy).

Table 4.7. Food Aid's Effects on Purchase

	Ln(Wheat Purchase kgs)		Ln(Other-Cereal Purchase kgs)	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
Food Aid				
FD cereals received (10kg) ^A	-0.004	-0.022	0.001	0.004
	(0.33)	(0.71)	(0.14)	(0.15)
FFW cereals received (10kg) ^A	-0.014	-0.046	0.038	-0.018
	(1.24)	(2.23)*	(3.65)**	(0.44)
Household Characteristics				
Household size	0.082	0.080	0.069	0.073
	(2.95)**	(2.87)**	(4.07)**	(4.18)**
Head's education (1)	0.017	0.013	0.135	0.135
	(0.16)	(0.11)	(1.92)	(1.90)
Head's age	0.002	0.002	0.004	0.004
	(0.37)	(0.35)	(1.44)	(1.45)
Female headed (1)	0.118	0.155	0.041	0.057
	(0.79)	(1.02)	(0.47)	(0.63)
Female headed, but head married (1)	0.036	0.046	0.145	0.143
	(0.19)	(0.24)	(1.16)	(1.14)
Fraction of children age under 6	0.068	0.074	-0.378	-0.416
	(0.22)	(0.23)	(1.94)	(2.09)*
Fraction of boys age between 7 and 14	-0.993	-1.005	0.076	-0.015
	(2.58)*	(2.59)**	(0.33)	(0.06)
Fraction of girls age between 7 and 14	-0.480	-0.448	0.330	0.254
	(1.25)	(1.16)	(1.38)	(1.03)
Fraction of elder age over 50	-0.125	-0.147	-0.361	-0.388
	(0.34)	(0.40)	(1.72)	(1.75)
Land owned, splined at 2 ha	-0.071	-0.081	-0.043	-0.031
	(0.73)	(0.82)	(0.72)	(0.50)
Land owned, over 2 ha	0.017	0.018	0.012	0.012
	(1.47)	(1.46)	(1.55)	(1.48)
Value of animals ('000 birr)	0.336	0.311	-0.140	-0.160
	(2.93)**	(2.66)**	(2.08)*	(2.27)*
Value of animals ^ 2	-0.042	-0.039	0.031	0.033
	(1.93)	(1.76)	(2.74)**	(2.88)**
Muslim (1)	-0.145	-0.156	-0.045	-0.060
	(0.71)	(0.76)	(0.36)	(0.48)
Protestant (1)	-0.075	-0.056	-0.137	-0.155
	(0.37)	(0.27)	(1.19)	(1.32)
Plot level shocks				
Fraction of plot areas with rain shortage	0.899	0.655	-0.065	-0.074
	(1.71)	(1.13)	(0.39)	(0.41)
Fraction of plot areas with flood	0.709	0.713	0.349	0.335
	(1.45)	(1.44)	(1.48)	(1.41)
Fraction of plot areas with crop disease/	0.863	1.066	-0.086	-0.113
Insect problems	(1.11)	(1.30)	(0.52)	(0.67)
Constant	4.485	4.274	5.297	5.314
	(3.95)**	(2.33)*	(4.71)**	(4.68)**
Hausman Test on Food Aid (k=2)		3.49		2.10
F stat. for IVs in first stages : FD		10.8 [0.00]**		10.5 [0.00]**
FFW		23.4 [0.00]**		9.93 [0.00]**
F test : Value of animal owned	4.95 [0.01]**	4.07 [0.02]*	3.87 [0.02]*	4.21 [0.02]*
Plot level shocks	2.15 [0.09]	2.04 [0.11]	0.92 [0.43]	0.92 [0.43]
Observations	0.49	0.48	0.38	0.37
R-squared	847	847	1951	1951

Note: Absolute t-statistics are in parentheses. P-values are in brackets. * indicates significant at 5% level; ** indicates significant at 1% level. A) Endogenous variables; Instruments are 4 interaction terms between wereda mean food aid received in kg for FD and FFW and household characteristics (land holdings and female head dummy).

Table 4.8. The Effects of Food Aid by Different Sets of IVs

	Main Results		Alternative IVs		
	OLS	IV[A] (# of IVs =12)	IV-1[B] (# of IVs = 10)	IV-2[C] (# of IVs = 6)	IV-3[D] (# of IVs = 4)
Ln (Wheat Sales kgs)					
FD crop received (10kg)[A]	-0.038	-0.018	-0.038	-0.049	-0.061
	(2.14)*	(0.66)	(1.22)	(1.48)	(1.76)
FFW crop received (10kg)[A]	-0.012	-0.005	-0.004	-0.007	-0.032
	(0.63)	(0.08)	(0.07)	(0.12)	(0.50)
F statistics of IVs on FD		16.0**	12.7**	18.1**	26.6**
F statistics of IVs on FFW		2.37**	2.63**	4.35**	6.17**
Hausman test statistics (k=2)		1.08	0.02	0.25	0.59
Ln (Other Cereal Sales kgs)					
FD crop received (10kg)[A]	0.001	-0.006	0.002	-0.021	-0.057
	(0.06)	(0.34)	(0.07)	(0.40)	(0.89)
FFW crop received (10kg)[A]	0.002	-0.008	-0.009	-0.010	-0.010
	(0.17)	(0.40)	(0.45)	(0.47)	(0.49)
F statistics of IVs on FD		27.1**	16.3**	5.46**	5.42**
F statistics of IVs on FFW		27.8**	31.3**	49.2**	73.1**
Hausman test statistics (k=2)		0.43	0.39	0.55	1.22
Ln (Wheat Purchase kgs)					
FD crop received (10kg)[A]	-0.004	-0.022	-0.033	-0.037	-0.007
	(0.33)	(0.71)	(0.66)	(0.34)	(0.06)
FFW crop received (10kg)[A]	-0.014	-0.046	-0.041	-0.046	-0.051
	(1.24)	(2.33)*	(1.99)*	(2.18)*	(2.37)*
F statistics of IVs on FD		10.8**	4.10**	1.41	2.03
F statistics of IVs on FFW		23.4**	26.4**	41.7**	60.6**
Hausman test statistics (k=2)		3.49	2.69	3.45	4.16
Ln (Other Cereal Purchase kgs)					
FD crop received (10kg)[A]	0.001	0.004	0.018	0.021	0.103
	(0.14)	(0.15)	(0.52)	(0.52)	(1.20)
FFW crop received (10kg)[A]	0.038	-0.018	-0.022	-0.001	0.184
	(3.65)**	(0.44)	(0.53)	(0.03)	(1.49)
F statistics of IVs on FD		10.5**	6.69**	8.67**	10.3**
F statistics of IVs on FFW		9.93**	11.3**	16.9**	11.7**
Hausman test statistics (k=2)		2.10	2.29	0.94	1.58

Note: Instrumental variables are interaction terms between two wereda means of cereals received in kilograms (from FD and FFW) and

A) A spline function of land holdings, a quadratic function of animal holdings, female head dummy, and plot level shock (shortage of rain).

A) A spline function of land holdings, a quadratic function of animal assets, and female head dummy.

B) Land holdings, animal assets, and female headed dummy. (No spline or quadratic functions).

C) Land holdings and female headed dummy. (Animal holdings is excluded.)

Chapter 5

Summary and Conclusions

The large volume of food aid received by Ethiopia over many years has raised some concerns on food aid's adverse effects on agricultural production. By taking an advantage of newly available household surveys conducted in 1996, I have analyzed food aid's effects on two important types of household behavior: child labor supply and crop marketing.

In the first analysis (Chapter 3), I have considered effects of food aid and household demographic composition on child farm labor supply controlling for household fixed effects. First, I estimated "reduced form" child farm labor supply with household demographic composition by ordered logits. Yet, some of household demographic composition, especially child composition, could be correlated with unobservable household characteristics. Thus, second, I estimated reduced from child farm labor supply with household fixed effects by conditional logits. Third, because it is difficult to estimate the level effects of food aid on child labor supply without plausible instrumental variables, I estimated differential effects of food aid on farm labor supply between boys and girls, boys and female adults, and girls and female adults with conditional logits.

The empirical results on "reduced form" child labor supply with conditional logits indicate that a child, especially a boy, has higher probability of working on farm if he or she is living with younger children, suggesting that older children living with younger

children are reducing resource constraints by working on farm. Thus the results suggest that reducing resource constraints by receiving food aid may reduce child farm labor supply.

The estimated results indicate that receiving free distribution has *relatively* larger positive effects on the probability of girls working on farm than boys, while participating in food for work has *relatively* larger positive effects on the probability of boys working on farm than girls. Therefore, the results suggest that the different types of food aid programs — a direct income transfer program and an employment program — have different effects on boys' and girls' farm labor supply.

In the second analysis (Chapter 4), I have considered food aid's potential price effects on cereal crops. Because food aid is provided to household directly, I estimated the effects of food aid on sales and purchases of wheat and other cereals. The estimated results from instrumental variable (IV) models indicate that receiving cereals form food for work decreases wheat purchases. The size of impact of food aid on wheat purchases increases as the amount of wheat purchases increases.

The results indicate that households decrease purchases of wheat when they participate in food for work programs. The size of impact increases as the amount of wheat purchases increases. Based on these empirical results we draw four policy implications. First, policy makers and food aid donors should recognize that different types of food aid programs have different effects on food crop marketing (and potentially on food crop prices). According to the results in this chapter, the two major food aid programs used in rural Ethiopia — free distribution and food for work — have different

effects on food crop marketing. Thus when policy makers discuss food aid's potential adverse effects on crop marketing, the types of food aid programs should be taken into account. Specially, the results show that providing wheat through food for work programs may depress local wheat prices through decreased wheat purchases and may discourage local wheat production. By contrast, providing wheat through free distribution did not have any significant effects. Therefore, in areas where many households produce and sell wheat, it may be a good idea to minimize the use of wheat in food for work programs.

Second, the estimated magnitude of food for work's effects on wheat purchases increases as the amount of wheat purchases increases. By estimating semi-log models, we found that receiving 10 kilograms of cereals from food for work decreases wheat purchases by 4.6 percent (of the total amount of wheat purchases). Therefore it is advisable to take additional cautions in using wheat as payments at food for work programs in areas where wheat purchases are high.

Third, we did not find monetization of food aid at household level. It is sometimes considered that the potential disincentive effects would occur through household sales of the crops provided as food aid (i.e., monetization). The results did not indicate any positive effects of food aid on sales of wheat and other cereals.

Forth, however, the results of this chapter suggest that potential disincentive effects can (and do) occur through household purchase behavior. Examining food aid's effects on household sales side only may leads monitoring agents to conclude that food aid has no effects on crop prices on markets. Yet, food aid may depress crop prices through decreasing purchases and this is what we found in rural Ethiopia. Therefore, a major

conclusion of this chapter is the needs to consider the effects of food aid on markets both from crop purchases as well as crop sales. The Bellman Amendment, Section 401 (b) of the United States Government's Agricultural Development and Trade Act of 1990 (the Farm Bill), for instance, only consider food aid's effects on sales side but not purchase side.

The results discussed in this chapter should be treated as short-run effects of food aid. Even the short-run effects in this chapter may not be generalized because of Ethiopia's well established relief institutions (governments and non-governmental organizations) and a long history of food aid distributions. More empirical results from other countries that are comparable with the results in this chapter will be necessary before we establish solid evidence of food aid's effects on crop marketing and local crop prices.

In this dissertation, I have examined food aid's potential adverse effects on agricultural production at household level. The results on the two types of household behavior — child labor supply and crop marketing — present mixed evidence on the potential adverse effects of food aid. Though important, studying these two types of household behavior does not provide the whole picture of food aid's effects on recipient countries' agricultural production and beyond. Positive effects of food aid, such as effects on child nutrition, should be examined carefully. Food aid's effects on political economy are increasingly becoming important in Africa, where recent famines have occurred within the context of armed conflicts. Militarization of food aid has been criticized heavily recently. More theoretical and empirical studies in these areas should be conducted in the future.

APPENDIX

Table A3.1. Descriptive Statistics

	Boys aged 7 to 10	Boys aged 11to 14	Girls aged 7 to 10	Girls aged 11 to 14
	Mean (S.D)	Mean (S.D)	Mean (S.D)	Mean (S.D)
Food Aid				
Value of FD	3.762	4.386	4.007	3.504
	(22.23)	(30.42)	(25.77)	(21.30)
Value of FFW	3.119	2.082	2.176	2.836
	(14.48)	(9.631)	(9.450)	(11.60)
Individual Characteristics				
Age	8.536	12.48	8.506	12.45
	(1.134)	(1.044)	(1.126)	(1.052)
Child w/step mom/dad (0,1)	0.168	0.210	0.185	0.207
	(0.374)	(0.407)	(0.389)	(0.406)
Child, relative (0,1)	0.113	0.155	0.124	0.175
	(0.317)	(0.362)	(0.330)	(0.380)
Demographic Composition				
Boys 0-6 (#)	0.745	0.611	0.742	0.623
	(0.812)	(0.774)	(0.822)	(0.805)
Girls 0-6 (#)	0.684	0.564	0.676	0.506
	(0.801)	(0.746)	(0.783)	(0.700)
Boys 7-10 (#)	0.309	0.483	0.295	0.492
	(0.515)	(0.639)	(0.510)	(0.652)
Girls 7-10 (#)	0.263	0.481	0.275	0.405
	(0.468)	(0.638)	(0.481)	(0.608)
Boys 11-14 (#)	0.386	0.226	0.433	0.254
	(0.592)	(0.436)	(0.601)	(0.492)
Girls 11-14 (#)	0.330	0.212	0.322	0.195
	(0.535)	(0.433)	(0.546)	(0.426)
Male adults 15-49 (#)	1.188	1.229	1.224	1.296
	(0.824)	(0.949)	(0.915)	(0.979)
Female adults 15-49 (#)	1.259	1.301	1.250	1.268
	(0.711)	(0.756)	(0.700)	(0.816)
Male Elderly 50- (#)	0.279	0.349	0.291	0.338
	(0.456)	(0.487)	(0.475)	(0.484)
Female Elderly 50- (#)	0.165	0.210	0.181	0.223
	(0.379)	(0.429)	(0.405)	(0.437)
Household Characteristics				
Household head's education	0.265	0.253	0.273	0.241
	(0.441)	(0.435)	(0.446)	(0.428)
Female headed household	0.101	0.115	0.108	0.148
	(0.302)	(0.320)	(0.310)	(0.356)
Female headed, but married	0.054	0.069	0.056	0.042
	(0.226)	(0.254)	(0.229)	(0.201)
Land owned (ha)	1.396	1.479	1.636	1.475
	(4.218)	(4.249)	(6.386)	(5.593)
Value of big animals ('000birr)	2.695	2.907	2.617	2.645
	(4.372)	(3.492)	(3.169)	(3.462)
Value of chickens ('000birr)	0.237	0.226	0.216	0.247
	(0.532)	(0.500)	(0.494)	(0.534)
Muslim (0,1)	0.304	0.288	0.309	0.293
	(0.460)	(0.453)	(0.462)	(0.455)
Protest (0,1)	0.138	0.129	0.124	0.122
	(0.345)	(0.335)	(0.330)	(0.327)
Livestock household (0,1)	0.008	0.012	0.010	0.012
	(0.091)	(0.108)	(0.100)	(0.109)
Regional Characteristics				
Average Rainfall (mm)	824.7	826.8	832.3	835.8
	(265.3)	(259.1)	(261.1)	(261.8)
Rainfall shocks in 1994 (mm)	110.1	104.5	110.1	111.3
	(179.9)	(180.7)	(186.6)	(183.7)
Rainfall shocks in 1995 (mm)	23.75	39.88	29.05	34.14
	(256.9)	(263.8)	(250.6)	(256.9)
Elevation	1961	1988	1967	1989
	(495.6)	(484.9)	(470.2)	(484.3)
Number of Observations	1384	1142	1240	960

Table A3.2. Reduced Form Farm Child Labor Supply Including FSS-Only Households (Ordered Logit)

	Boys		Girls	
	Aged 7 to 10	Aged 11 to 14	Aged 7 to 10	Aged 11 to 14
Individual Characteristics				
Age	0.600	0.091	0.698	0.123
	(7.62)**	(0.97)	(7.44)**	(1.19)
Child w/step mom/dad (0,1)	0.074	-0.021	0.082	0.116
	(0.30)	(0.08)	(0.31)	(0.37)
Child, relative (0,1)	-0.295	0.645	0.156	-0.684
	(0.87)	(2.09)*	(0.51)	(1.90)
Sibling Composition				
Boys 0-6 (#)	0.072	-0.074	-0.024	-0.286
	(0.72)	(0.61)	(0.21)	(2.15)*
Girls 0-6 (#)	0.134	-0.072	0.131	-0.022
	(1.33)	(0.62)	(1.14)	(0.16)
Younger boys (7-14)	0.040	0.164	-0.305	0.023
	(0.20)	(1.38)	(1.26)	(0.16)
Younger girls (7-14)	0.017	0.289	-0.087	0.007
	(0.08)	(2.34)*	(0.35)	(0.04)
Older boys (7-14)	-0.460	-0.392	-0.403	-0.546
	(3.99)**	(1.55)	(3.01)**	(1.70)
Older girls (7-14)	-0.370	-0.038	-0.044	-0.344
	(2.96)**	(0.14)	(0.33)	(1.01)
Demographic Composition				
Male adults 15-49 (#)	-0.029	-0.179	-0.086	-0.361
	(0.30)	(1.89)	(0.80)	(3.24)**
Female adults 15-49 (#)	-0.026	0.109	0.177	0.297
	(0.23)	(0.91)	(1.46)	(2.19)*
Male Elderly 50- (#)	0.038	-0.290	0.049	-0.417
	(0.21)	(1.40)	(0.23)	(1.65)
Female Elderly 50- (#)	0.505	0.076	0.185	0.577
	(2.08)*	(0.32)	(0.70)	(2.08)*
Household Characteristics				
Household head's education (0,1)	-0.374	-0.750	-0.166	-0.745
	(2.09)*	(3.64)**	(0.78)	(2.95)**
Female headed household (0,1)	-0.604	-0.829	-0.102	-0.304
	(1.80)	(2.26)*	(0.27)	(0.77)
Female headed, but married (0,1)	-0.406	-0.770	0.229	-1.011
	(1.08)	(1.89)	(0.54)	(1.72)
Land owned (ha)	0.020	-0.051	-0.004	-0.018
	(1.40)	(2.16)*	(0.31)	(1.16)
Value of big animals ('000birr) [1]	N.A.	N.A.	N.A.	N.A.
Value of chickens (birr) [1]	N.A.	N.A.	N.A.	N.A.
Muslim (0,1)	-0.345	0.248	0.146	0.118
	(1.03)	(0.68)	(0.36)	(0.27)
Protest (0,1)	0.493	0.565	-0.287	0.525
	(1.69)	(1.61)	(0.78)	(1.34)
Livestock household (0,1)	-0.275	-0.588	0.062	0.304
	(0.25)	(0.80)	(0.06)	(0.39)
Log Likelihood	-947.2	-737.0	-731.3	-533.2
Observations	1146	862	935	619

Note: 1) Fss-only households do no t have information on animal holdings. Fss-only households are more likely to be female headed, with less land holdings, and have more relative children.

Table A4.1. Descriptive Statistics

	Mean	S.D.	Min	Max
Dependent Variables				
Sales (1)	0.585	0.493	0	1
Purchase (1)	0.769	0.422	0	1
Ln (gross sales, kgs) n = 2281	4.905	1.429	-1.386	8.768
Ln (gross purchase, kgs) n = 2997	4.467	1.382	-2.513	8.344
Food Aid Received				
FD crop received (10kg)	1.139	5.263	0	125
FFW crop received (10kg)	0.730	3.597	0	62.6
Household Characteristics				
Household size	5.058	2.217	1	18
Head's education (1)	0.264	0.441	0	1
Head's age	44.33	14.98	13	101
Female headed (1)	0.138	0.345	0	1
Female headed, but head married (1)	0.052	0.221	0	1
Fraction of children age under 6	0.208	0.186	0	0.8
Fraction of boys age between 7 and 14	0.110	0.137	0	0.8
Fraction of girls age between 7 and 14	0.096	0.132	0	0.67
Fraction of elder age over 50	0.131	0.219	0	1
Muslim (1)	0.285	0.451	0	1
Protestant (1)	0.126	0.332	0	1
Land owned (ha)	1.252	3.918	0	91.86
Value of animals ('000 birr)	0.766	0.971	0	18.13
Plot Level Shocks				
Fraction of plot areas with rain shortage	0.080	0.227	0	1
Fraction of plot areas with flood	0.037	0.137	0	1
Fraction of plot areas with crop disease/Insect problems	0.073	0.179	0	1
Wereda Level Variables				
Price of food crops (birr/kg)	0.894	0.453	0.017	3
Elevation (mm) * 10e-2	19.88	5.009	5	35
Average Rainfall (mm) * 10e-2	8.351	2.658	2.097	16.47
Rainfall shocks in 1994 (mm) * 10e-2	1.094	1.879	-1.805	6.159
Rainfall shocks in 1995 (mm) * 10e-2	0.334	2.630	-5.564	9.686
Distance to Bus station (10km)	18.25	17.68	0	92.96
Observations	3899			

Table A4.2. Marketing with Self-Selection — Sales

	Wheat		Other Cereals	
	OLS	Heckman's Two-step OLS [A]	OLS	Heckman's Two-step OLS [A]
Household Characteristics				
Household size	0.109	0.134	0.032	0.022
	(3.16)**	(0.07)	(1.56)	(0.31)
Head's education (1)	-0.026	0.277	0.219	0.302
	(0.17)	(0.02)	(2.72)**	(0.86)
Head's age	-0.002	-0.006	0.001	-4.4*10e-4
	(0.23)	(0.02)	(0.17)	(0.04)
Female headed (1)	0.166	-0.037	-0.012	-0.188
	(0.76)	(0.01)	(0.09)	(0.30)
Female headed, but head married (1)	0.320	0.518	-0.163	-0.242
	(0.92)	(0.03)	(0.98)	(0.38)
Fraction of children age under 6	0.169	0.529	0.096	0.167
	(0.35)	(0.02)	(0.43)	(0.25)
Fraction of boys age between 7 and 14	-0.540	-0.421	-0.047	0.029
	(0.95)	(0.02)	(0.17)	(0.04)
Fraction of girls age between 7 and 14	0.158	-1.132	-0.013	-0.287
	(0.25)	(0.02)	(0.04)	(0.24)
Fraction of elder age over 50	0.087	-0.846	-0.041	-0.188
	(0.16)	(0.16)	(0.16)	(0.18)
Land owned, splined at 2 ha	0.160	0.893	0.200	0.426
	(1.07)	(0.04)	(2.73)**	(0.64)
Land owned, over 2 ha	0.055	-0.026	-0.006	-0.012
	(0.49)	(0.00)	(0.65)	(0.45)
Value of animals ('000 birr)	0.294	0.517	0.151	0.250
	(2.89)**	(0.06)	(2.06)*	(0.62)
Value of animals ^ 2	-0.014	-0.022	-0.026	-0.037
	(2.16)*	(0.07)	(2.32)*	(0.44)
Muslim (1)	-0.498	-0.623	-0.063	-0.137
	(1.23)	(0.06)	(0.43)	(0.27)
Protestant (1)	0.316	0.007	-0.039	-0.115
	(0.98)	(0.00)	(0.28)	(0.24)
Plot level shocks				
Fraction of plot areas with rain shortage	0.425	-0.505	0.215	0.083
	(0.90)	(0.01)	(1.04)	(0.12)
Fraction of plot areas with flood	0.714	1.295	-0.022	-0.201
	(1.46)	(0.05)	(0.07)	(0.17)
Fraction of plot areas with crop disease/ Insect problems	1.261	-0.484	-0.196	-0.345
	(1.67)	(0.01)	(0.90)	(0.43)
The inverse Mill's ratio		2.682		0.988
		(0.02)		(0.31)
	Wereda dummies		Wereda dummies	
Constant	4.130	-0.155	1.552	-0.215
	(4.02)**	(0.00)	(1.55)	(0.03)
Wald test				
Value of animals		0.03 [0.94]		0.45 [0.80]
R squared	0.67		0.54	
Observations	357	357 [B], 1425 [C]	1235	1235 [B], 3254 [C]

Note: Absolute values of z-statistics are in parentheses. Numbers in brackets are p-values. * indicates significant at 5 % level; ** indicates significant at 1 % level. A) Standard errors are corrected. B) Number of uncensored observations.

C) Number of total observations.

Table A4.3. Marketing with Self-Selection — Purchase

	Wheat		Other Cereals	
	OLS	Heckman's Two-step OLS [A]	OLS	Heckman's Two-step OLS [A]
Household Characteristics				
Household size	0.083	0.084	0.072	0.082
	(2.98)**	(1.40)	(4.20)**	(2.45)*
Head's education (1)	0.017	0.007	0.135	0.122
	(0.16)	(0.03)	(1.91)	(0.91)
Head's age	0.002	0.001	0.004	0.005
	(0.37)	(0.09)	(1.45)	(0.91)
Female headed (1)	0.104	0.092	0.053	0.179
	(0.70)	(0.27)	(0.61)	(0.70)
Female headed, but head married (1)	0.033	0.015	0.145	0.275
	(0.17)	(0.04)	(1.16)	(0.91)
Fraction of children age under 6	0.069	0.082	-0.403	-0.293
	(0.22)	(0.11)	(2.06)*	(0.70)
Fraction of boys age between 7 and 14	-0.985	-0.958	0.014	0.215
	(2.56)*	(1.02)	(0.06)	(0.38)
Fraction of girls age between 7 and 14	-0.489	-0.473	0.279	0.553
	(1.28)	(0.58)	(1.17)	(0.83)
Fraction of elder age over 50	-0.112	-0.044	-0.371	-0.422
	(0.31)	(0.03)	(1.77)	(0.96)
Land owned, splined at 2 ha	-0.066	-0.058	-0.034	-0.148
	(0.67)	(0.24)	(0.56)	(0.66)
Land owned, over 2 ha	0.017	0.016	0.012	0.016
	(1.47)	(0.39)	(1.50)	(1.13)
Value of animals ('000 birr)	0.345	0.350	-0.155	-0.225
	(3.02)**	(0.74)	(2.30)*	(0.96)
Value of animals ^ 2	-0.044	-0.044	0.032	0.038
	(1.99)*	(0.41)	(2.89)**	(0.82)
Muslim (1)	-0.139	-0.113	-0.056	-0.041
	(0.69)	(0.17)	(0.45)	(0.17)
Protestant (1)	-0.081	-0.058	-0.148	-0.222
	(0.39)	(0.10)	(1.28)	(0.90)
Plot level shocks				
Fraction of plot areas with rain shortage	-0.023	-0.064	-0.062	0.155
	(0.09)	(0.07)	(0.38)	(0.30)
Fraction of plot areas with flood	0.899	0.866	0.341	0.392
	(2.43)*	(0.81)	(1.44)	(0.88)
Fraction of plot areas with crop disease/ Insect problems	-0.165	-0.179	-0.105	0.019
	(0.67)	(0.35)	(0.63)	(0.05)
The inverse Mill's ratio		-0.141		1.044
		(0.05)		(0.50)
	Wereda dummies		Wereda dummies	
Constant	1.697	1.842	5.306	0.367
	(2.49)*	(0.56)	(4.70)**	(0.71)
Wald test				
Value of animals	5.26 [0.01]**	1.49 [0.47]	4.22 [0.02]*	0.92 [0.63]
R squared	0.48		0.38	
Observations	847	847 [B], 2890 [C]	1951	1951 [B], 3520 [C]

Note: Absolute values of z-statistics are in parentheses. Numbers in brackets are p-values. * indicates significant at 5 % level; ** indicates significant at 1 % level. A) Standard errors are corrected. B) Number of uncensored observations. C) Number of total observations.

Table A4.4. The Effects of Food Aid on Stock Level

	Ln(Wheat Stock kgs)		Ln(Other Cereals Stock kgs)	
	OLS	IV	OLS	IV
Food Aid				
FD cereals received (10kg) A	0.001	-0.030	0.011	0.023
	(0.07)	(0.32)	(1.89)	(0.59)
FFW cereals received (10kg) A	-0.002	-0.282	0.007	-0.016
	(0.12)	(1.08)	(0.73)	(0.64)
Household Characteristics				
Household size	0.082	0.130	0.091	0.090
	(2.74)**	(2.18)*	(4.51)**	(4.44)**
Head's education (1)	0.037	0.002	0.159	0.152
	(0.29)	(0.01)	(2.03)*	(1.92)
Head's age	-0.011	-0.016	-0.003	-0.003
	(1.77)	(1.59)	(0.93)	(1.00)
Female headed (1)	0.214	0.421	-0.183	-0.177
	(1.07)	(1.28)	(1.52)	(1.43)
Female headed, but head married (1)	0.121	0.112	-0.119	-0.127
	(0.39)	(0.27)	(0.75)	(0.80)
Fraction of children age under 6	0.158	-0.032	-0.109	-0.094
	(0.39)	(0.06)	(0.49)	(0.39)
Fraction of boys age between 7 and 14	-0.008	-0.107	0.003	-0.029
	(0.02)	(0.17)	(0.01)	(0.10)
Fraction of girls age between 7 and 14	-1.134	-1.643	-0.129	-0.081
	(2.25)*	(1.84)	(0.44)	(0.27)
Fraction of elder age over 50	-0.052	-0.157	0.087	0.088
	(0.11)	(0.25)	(0.36)	(0.36)
Land owned, splined at 2 ha	0.292	0.265	0.197	0.192
	(2.41)*	(1.53)	(2.85)**	(2.75)**
Land owned, over 2 ha	-0.064	-0.068	-0.047	-0.047
	(0.61)	(0.48)	(3.64)**	(3.60)**
Value of animals ('000 birr)	0.260	0.236	0.301	0.305
	(2.81)**	(1.70)	(5.55)**	(4.78)**
Value of animals ^ 2	-0.005	-0.005	-0.015	-0.015
	(0.82)	(0.53)	(3.01)**	(2.89)**
Muslim (1)	-0.139	0.086	-0.094	-0.099
	(0.48)	(0.20)	(0.66)	(0.68)
Protestant (1)	0.365	0.447	-0.188	-0.190
	(1.02)	(0.91)	(1.25)	(1.25)
Plot level shocks				
Fraction of plot areas with rain shortage	0.102	-0.052	-0.270	-0.352
	(0.25)	(0.07)	(1.25)	(1.36)
Fraction of plot areas with flood	-0.158	-0.397	-0.646	-0.639
	(0.38)	(0.63)	(2.53)*	(2.48)*
Fraction of plot areas with crop disease/	-0.223	-0.660	-0.181	-0.153
Insect problems	(0.42)	(0.80)	(0.88)	(0.72)
	Wereda dummies		Wereda dummies	
Constant	3.103	3.327	3.678	3.730
	(2.93)**	(2.30)*	(4.58)**	(4.61)**
F statistics for IVs in first stages				
FD		8.00 [0.00]**		7.42 [0.00]**
FFW		1.16 [0.33]		45.8 [0.00]**
F statistics Value of animal owned	8.18 [0.00]**	2.91 [0.06]	16.7 [0.00]**	11.9 [0.00]**
Plot level shocks	0.15 [0.93]	0.30 [0.83]	2.70 [0.04]*	2.66 [0.05]*
R squared	0.68	0.41	0.52	0.52
Observations	514	514	1519	1519

Note: Absolute t-statistics are in parentheses. P-values are in brackets. * indicates significant at 5% level; ** indicates significant at 1% level. A) Endogenous variables; Instruments are 6 interaction terms between wereda mean food aid received in kg for FD and FFW and household characteristics (land holdings, value of animal holdings, and female head dummy).

Table A**. The Effects of Food Aid on Wheat Production

	Ln(Wheat Production kgs)			
	OLS	IV - 1 [B]	IV - 2 [B]	IV - 3 [B]
Food Aid				
FD cereals received (10kg) [A]	-0.018	0.001	-0.043	-0.079
	(2.52)*	(0.04)	(2.04)*	(2.54)*
FFW cereals received (10kg) [A]	-0.010	0.250	0.077	0.258
	(0.69)	(1.10)	(0.35)	(0.84)
Household Characteristics				
Household size	0.052	0.047	0.055	0.060
	(2.04)*	(1.52)	(2.06)*	(1.78)
Head's education (1)	0.139	0.176	0.148	0.170
	(1.35)	(1.36)	(1.33)	(1.21)
Head's age	-0.003	-0.004	-0.004	-0.005
	(0.64)	(0.66)	(0.74)	(0.78)
Female headed (1)	-0.005	-0.012	0.002	0.010
	(0.03)	(0.06)	(0.01)	(0.05)
Female headed, but head married (1)	0.532	0.595	0.551	0.592
	(2.52)*	(2.26)*	(2.43)*	(2.08)*
Fraction of children age under 6	0.555	0.461	0.478	0.344
	(1.76)	(1.16)	(1.40)	(0.80)
Fraction of boys age between 7 and 14	0.516	0.504	0.485	0.435
	(1.44)	(1.15)	(1.30)	(0.93)
Fraction of girls age between 7 and 14	-0.064	0.000	-0.101	-0.147
	(0.16)	(0.00)	(0.24)	(0.28)
Fraction of elder age over 50	0.215	0.319	0.305	0.461
	(0.63)	(0.74)	(0.82)	(0.98)
Land owned, splined at 2 ha	0.391	0.366	0.424	0.470
	(4.02)**	(3.04)**	(4.06)**	(3.56)**
Land owned, over 2 ha	-0.203	-0.189	-0.208	-0.213
	(3.07)**	(2.32)*	(2.98)**	(2.45)*
Value of animals ('000 birr)	0.127	0.156	0.106	0.078
	(1.77)	(1.73)	(1.34)	(0.78)
Value of animals ^ 2	0.000	-0.001	0.001	0.003
	(0.05)	(0.18)	(0.24)	(0.38)
Muslim (1)	-0.167	-0.156	-0.176	-0.187
	(0.76)	(0.58)	(0.77)	(0.65)
Protestant (1)	-0.162	-0.199	-0.182	-0.219
	(0.58)	(0.58)	(0.62)	(0.60)
Plot level shocks				
Fraction of plot areas with rain shortage	0.287	0.726	0.670	1.337
	(1.15)	(1.29)	(1.31)	(1.82)
Fraction of plot areas with flood	-0.194	-0.133	-0.163	-0.105
	(0.58)	(0.32)	(0.46)	(0.24)
Fraction of plot areas with crop disease/	-0.936	-0.589	-0.968	-0.955
Insect problems	(3.07)**	(1.29)	(2.29)*	(1.77)
	Wereda dummies		Wereda dummies	
Constant	4.782	0.057	3.704	3.817
	(4.15)**	(0.00)	(3.16)**	(2.60)**
R squared	0.65	0.61	0.50	0.41
Observations	841	841	841	841

Note: Absolute t-statistics are in parentheses. P-values are in brackets. * indicates significant at 5% level; ** indicates significant at 1% level. A) Endogenous variables. B) See the note at the bottom of Table A 4.5.

Table A4.5. The Effects of Food Aid on Maize and Sorghum Marketing

	Ln(Sales kgs)		Ln(Purchase kgs)	
	OLS	IV	OLS	IV
Food Aid				
FD crop received (10kg) A	-0.030	0.006	0.001	-0.009
	(1.74)	(0.09)	(0.08)	(0.20)
FFW crop received (10kg) A	-0.004	-0.012	0.011	0.010
	(0.33)	(0.59)	(1.06)	(0.27)
Household Characteristics				
Household size	0.044	0.040	0.077	0.078
	(2.09)*	(1.84)	(4.59)**	(4.41)**
Head's education	0.203	0.202	0.018	0.016
	(2.39)*	(2.37)*	(0.26)	(0.23)
Head's age	0.004	0.004	0.002	0.002
	(1.04)	(1.06)	(0.72)	(0.58)
Female headed	-0.145	-0.167	-0.060	-0.056
	(1.14)	(1.24)	(0.70)	(0.63)
Female headed, but head married	-0.133	-0.129	0.051	0.054
	(0.76)	(0.73)	(0.42)	(0.44)
Fraction of children age under 6	0.388	0.392	-0.333	-0.333
	(1.68)	(1.69)	(1.71)	(1.68)
Fraction of boys age between 7 and 14	0.170	0.150	-0.063	-0.063
	(0.60)	(0.52)	(0.28)	(0.27)
Fraction of girls age between 7 and 14	0.093	0.113	0.079	0.081
	(0.30)	(0.36)	(0.34)	(0.34)
Fraction of elder age over 50	-0.106	-0.135	-0.339	-0.311
	(0.39)	(0.50)	(1.62)	(1.28)
Muslim	0.110	0.104	0.054	0.052
	(0.72)	(0.68)	(0.42)	(0.40)
Protestant	-0.169	-0.175	-0.232	-0.228
	(1.20)	(1.23)	(2.19)*	(2.14)*
Land owned (ha)	-0.031	-0.031	-0.004	-0.004
	(2.68)**	(2.68)**	(0.56)	(0.56)
Value of animals ('000 birr)	0.246	0.258	-0.046	-0.050
	(3.25)**	(3.25)**	(0.67)	(0.69)
Value of animals ^ 2	-0.041	-0.042	0.014	0.015
	(3.38)**	(3.41)**	(1.23)	(1.23)
Plot level shocks				
Fraction of plot areas with rain shortage	0.065	0.066	0.040	0.055
	(0.28)	(0.28)	(0.25)	(0.31)
Fraction of plot areas with flood	-0.153	-0.183	0.395	0.396
	(0.50)	(0.58)	(1.71)	(1.71)
Fraction of plot areas with crop disease/	-0.330	-0.327	-0.056	-0.057
Insect problems	(1.45)	(1.43)	(0.35)	(0.35)
	Wereda dummies		Wereda dummies	
Constant	1.806	1.846	5.323	5.323
	(1.85)	(1.88)	(4.91)**	(4.91)**
F statistics for IVs in first stages				
FD				
FFW				
F statistics Value of animal owned	6.07 [0.00]**	6.11 [0.00]**	1.01 [0.36]	1.01 [0.36]
Plot level shocks	0.81 [0.49]	0.81 [0.49]	1.08 [0.36]	1.09 [0.35]
R squared	0.58	0.58	0.43	0.43
Observations	1085	1085	1843	1843

Note: Absolute t-statistics are in parentheses. P-values are in brackets. * indicates significant at 5% level; ** indicates significant at 1% level. A) Endogenous variables; Instruments are 6 interaction terms between wereda mean food aid received in kg for FD and FFW and household characteristics (land holdings, value of animal holdings, and female head dummy).

Table A4.6. Food Aid's Effects on Teff Marketing

	Ln(Teff Sales kgs)		Ln(Teff Purchase kgs)	
	OLS	IV	OLS	IV
Food Aid				
FD cereals received (10kg) ^A	-0.036	-0.124	-0.005	0.072
	(2.21)*	(1.41)	(0.16)	(0.57)
FFW cereals received (10kg) ^A	0.003	3.0*10e-5	-0.027	0.021
	(0.33)	(0.00)	(0.82)	(0.23)
Household Characteristics				
Household size	0.048	0.046	0.103	0.102
	(2.06)*	(1.96)	(2.58)*	(2.50)*
Head's education (1)	0.153	0.150	0.063	0.084
	(1.59)	(1.49)	(0.42)	(0.54)
Head's age	-0.002	-0.002	-0.015	-0.015
	(0.52)	(0.48)	(2.38)*	(2.41)*
Female headed (1)	-0.290	-0.274	0.234	0.207
	(2.12)*	(1.95)	(1.17)	(0.99)
Female headed, but head married (1)	0.032	0.051	0.110	0.029
	(0.15)	(0.24)	(0.42)	(0.10)
Fraction of children age under 6	-0.180	-0.157	-0.429	-0.428
	(0.66)	(0.55)	(1.05)	(1.02)
Fraction of boys age between 7 and 14	0.165	0.087	-0.663	-0.666
	(0.50)	(0.25)	(1.27)	(1.25)
Fraction of girls age between 7 and 14	-0.040	-0.097	-0.189	-0.105
	(0.11)	(0.26)	(0.36)	(0.19)
Fraction of elder age over 50	-0.139	-0.114	0.086	0.155
	(0.44)	(0.35)	(0.20)	(0.34)
Land owned, splined at 2 ha	0.251	0.281	-0.045	-0.054
	(2.94)**	(3.05)**	(0.32)	(0.37)
Land owned, over 2 ha	-0.019	-0.030	0.019	0.020
	(0.25)	(0.39)	(1.87)	(1.88)
Value of animals ('000 birr)	0.074	0.033	0.155	0.172
	(0.82)	(0.34)	(0.96)	(1.04)
Value of animals ^ 2	-0.023	-0.020	-0.005	-0.006
	(1.37)	(1.13)	(0.14)	(0.19)
Muslim (1)	0.288	0.261	0.412	0.433
	(1.34)	(1.17)	(1.44)	(1.48)
Protestant (1)	-0.253	-0.259	0.016	-0.007
	(1.28)	(1.27)	(0.07)	(0.03)
Plot level shocks				
Fraction of plot areas with rain shortage	0.333	0.596	-0.086	-0.267
	(1.25)	(1.58)	(0.24)	(0.59)
Fraction of plot areas with flood	0.596	0.603	-0.100	-0.276
	(1.80)	(1.78)	(0.14)	(0.36)
Fraction of plot areas with crop disease/	0.219	0.340	0.006	0.070
Insect problems	(0.65)	(0.92)	(0.02)	(0.19)
	Wereda dummies		Wereda dummies	
Constant	4.010	4.005	6.056	6.088
	(4.01)**	(3.91)**	(5.26)**	(5.19)**
F statistics for IVs in first stages				
FD		9.27 [0.00]**		5.30 [0.00]**
FFW		44.9 [0.00]**		15.6 [0.00]**
F statistics Value of animal owned	1.03 [0.36]	1.04 [0.35]	1.60 [0.20]	1.70 [0.18]
Plot level shocks	1.53 [0.21]	1.80 [0.15]	0.03 [0.99]	0.14 [0.94]
R-squared	0.55	0.53	0.61	0.59
Observations	880	880	495	495

Note: Absolute t-statistics are in parentheses. P-values are in brackets. * indicates significant at 5% level; ** indicates significant at 1% level. A) Endogenous variables; Instruments are 4 interaction terms between wereda mean food aid received in kg for FD and FFW and household characteristics (land holdings and female head dummy).

Table A4.7. The Effects of Food Aid on *Net* Sales and Purchase

	Ln(Net Sales kgs)		Ln(Net Purchase kgs)	
	OLS	IV	OLS	IV
Food Aid				
FD crop received (10kg) A	-0.001	0.009	-0.002	0.036
	(0.10)	(0.14)	(0.35)	(1.36)
FFW crop received (10kg) A	-0.001	-0.006	0.037	0.024
	(0.11)	(0.23)	(3.50)**	(0.65)
Household characteristics				
Household size	0.085	0.084	0.079	0.079
	(4.45)**	(4.28)**	(4.05)**	(3.94)**
Head's education	0.153	0.150	0.124	0.132
	(1.94)	(1.88)	(1.52)	(1.61)
Head's age	0.004	0.004	0.003	0.003
	(1.25)	(1.23)	(0.88)	(1.00)
Female headed	-0.308	-0.308	-0.011	-0.013
	(2.66)**	(2.65)**	(0.11)	(0.13)
Female headed, but head married	-0.255	-0.256	0.125	0.111
	(1.53)	(1.53)	(0.90)	(0.79)
Fraction of children age under 6	0.252	0.253	-0.278	-0.287
	(1.15)	(1.15)	(1.27)	(1.28)
Fraction of boys age between 7 and 14	-0.104	-0.108	-0.321	-0.347
	(0.39)	(0.40)	(1.24)	(1.31)
Fraction of girls age between 7 and 14	-0.456	-0.444	0.009	-0.019
	(1.62)	(1.55)	(0.03)	(0.07)
Fraction of elder age over 50	-0.272	-0.277	-0.127	-0.197
	(1.10)	(1.11)	(0.55)	(0.83)
Muslim	0.149	0.149	-0.223	-0.220
	(0.98)	(0.98)	(1.66)	(1.62)
Protestant	-0.135	-0.136	-0.045	-0.057
	(0.95)	(0.96)	(0.38)	(0.48)
Land owned (ha)	0.003	0.003	0.018	0.018
	(0.29)	(0.28)	(2.48)*	(2.43)*
Value of animals ('000 birr)	0.123	0.125	-0.062	-0.047
	(2.25)*	(2.15)*	(0.82)	(0.58)
Value of animals ^ 2	-0.005	-0.005	0.021	0.021
	(0.95)	(0.95)	(1.66)	(1.61)
Plot level shocks				
Fraction of plot areas with rain shortage	0.197	0.151	0.241	0.111
	(0.84)	(0.45)	(1.37)	(0.56)
Fraction of plot areas with flood	-0.079	-0.085	0.145	0.150
	(0.29)	(0.31)	(0.57)	(0.58)
Fraction of plot areas with crop disease/	0.052	0.079	-0.306	-0.304
Insect problems	(0.22)	(0.27)	(1.75)	(1.71)
	Wereda dummies		Wereda dummies	
Constant	1.894	1.902	5.378	5.415
	(1.66)	(1.66)	(4.28)**	(4.26)**
F statistics for IVs in first stages				
FD		5.92 [0.00]**		19.4 [0.00]**
FFW		29.6 [0.00]**		48.6 [0.00]**
F statistics Value of animal owned	3.26 [0.04]*	2.99 [0.05]	1.99 [0.14]	2.34 [0.10]
Plot level shocks	0.27 [0.85]	0.18 [0.91]	1.95 [0.12]	1.30 [0.27]
R-squared	0.51	0.51	0.42	0.40
Observations	1667	1667	1916	1916

Note:* indicates significant at 5% level; ** indicates significant at 1% level. A) Endogenous variables; Instruments are 6 interaction terms between wereda mean food aid received in kg for FD and FFW and household characteristics (land holdings, value of animal holdings, and female head dummy).

Table A4.8. The Effects of Food Aid on Sales in North Region [B]

	Ln(Wheat Sales kgs)		Ln(Other cereal Sales kgs)	
	OLS	IV	OLS	IV
Food Aid				
FD crop received (10kg) [A]	0.000	0.022	0.005	-0.013
	(0.01)	(0.47)	(0.52)	(0.48)
FFW crop received (10kg) [A]	-0.012	0.028	0.007	0.001
	(0.39)	(0.35)	(0.60)	(0.03)
Household characteristics				
Household size	0.034	0.012	0.050	0.054
	(0.42)	(0.13)	(1.49)	(1.58)
Head's education	-0.653	-0.665	0.328	0.325
	(2.34)*	(2.32)*	(2.74)**	(2.69)**
Head's age	0.007	0.010	-0.004	-0.004
	(0.41)	(0.58)	(0.72)	(0.66)
Female headed	-0.164	-0.148	-0.113	-0.089
	(0.27)	(0.21)	(0.63)	(0.49)
Female headed, but head married	0.000	0.000	-0.205	-0.255
	(.)	(.)	(0.48)	(0.59)
Fraction of children age under 6	-0.132	-0.222	0.565	0.500
	(0.12)	(0.19)	(1.53)	(1.31)
Fraction of boys age 7-14	0.876	0.946	0.699	0.711
	(0.69)	(0.72)	(1.66)	(1.67)
Fraction of girls age 7-14	1.362	1.767	-0.053	-0.102
	(1.04)	(1.18)	(0.12)	(0.22)
Fraction of elder age over 50	-0.169	-0.272	0.561	0.517
	(0.17)	(0.27)	(1.38)	(1.25)
Muslim	-2.072	0.213	0.268	0.289
	(1.28)	(0.08)	(0.70)	(0.75)
Protestant	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
Land owned (ha)	-0.689	-0.752	0.130	0.125
	(1.75)	(1.62)	(1.55)	(1.47)
Value of animals ('000 birr)	1.185	1.297	0.030	0.015
	(2.74)**	(2.65)*	(0.18)	(0.09)
Value of animals ^ 2	-0.308	-0.327	-0.005	-0.005
	(3.03)**	(2.91)**	(0.10)	(0.09)
Plot level shocks				
Fraction of plot areas with rain shortage	0.313	0.061	0.101	0.219
	(0.47)	(0.07)	(0.36)	(0.65)
Fraction of plot areas with flood	0.992	0.899	-0.172	-0.158
	(1.08)	(0.93)	(0.49)	(0.45)
Fraction of plot areas with crop disease/	1.993	2.270	-0.086	-0.167
Insect problems	(1.81)	(1.78)	(0.25)	(0.46)
	Wereda dummies		Wereda dummies	
Constant	5.591	3.316	1.677	1.653
	(3.33)**	(1.26)	(1.69)	(1.65)
Observations	114	114	533	533
R-squared	0.79	0.54		

Note: * indicates significant at 5% level; ** indicates significant at 1% level. A) Endogenous variables; Instruments are 6 interaction terms between wereda mean food aid received in kg for FD and FFW and household characteristics (land holdings, value of animal holdings, and female head dummy). B) North region includes Tigray, North and South Gonder, East Gojjam, West Gojjam, Agewawi, North Wello, Wag Hamra, South Wello, North Shewa, and Oromiya. These are regions where people consume Sorghum and Teff.

Table A4.9. The Effects of Food Aid on Purchase in North Region [B]

	Ln(Wheat Purchase kgs)		Ln(Other Cereal Purchase kgs)	
	OLS	IV	OLS	IV
Food Aid				
FD crop received (10kg) [A]	0.004	-0.056	0.003	0.113
	(0.27)	(0.77)	(0.47)	(2.75)**
FFW crop received (10kg) [A]	-0.015	-0.029	0.039	-0.036
	(1.08)	(1.27)	(3.28)**	(0.71)
Household characteristics				
Household size	0.073	0.078	0.055	0.041
	(1.58)	(1.58)	(1.72)	(1.01)
Head's education	-0.072	-0.140	0.088	0.133
	(0.40)	(0.68)	(0.74)	(0.92)
Head's age	-0.004	-0.006	0.003	0.011
	(0.48)	(0.68)	(0.58)	(1.58)
Female headed	-0.014	0.116	-0.092	-0.088
	(0.06)	(0.41)	(0.63)	(0.50)
Female headed, but head married	-0.293	-0.215	0.062	0.050
	(0.82)	(0.57)	(0.22)	(0.15)
Fraction of children age under 6	-0.107	-0.032	-0.780	-0.915
	(0.20)	(0.06)	(2.20)*	(2.10)*
Fraction of boys age 7-14	-0.611	-0.556	-0.132	-0.409
	(1.01)	(0.88)	(0.34)	(0.83)
Fraction of girls age 7-14	-0.480	-0.203	0.417	0.209
	(0.73)	(0.28)	(1.00)	(0.41)
Fraction of elder age over 50	0.180	0.207	-1.001	-1.731
	(0.32)	(0.36)	(2.90)**	(3.53)**
Muslim	-0.024	-0.029	-0.382	-0.358
	(0.05)	(0.06)	(1.38)	(1.05)
Protestant	0.338	0.363	1.949	1.871
	(0.22)	(0.23)	(1.57)	(1.25)
Land owned (ha)	0.174	0.180	-0.093	-0.106
	(1.54)	(1.43)	(1.77)	(1.65)
Value of animals ('000 birr)	0.363	0.319	-0.089	-0.073
	(1.51)	(1.26)	(0.66)	(0.43)
Value of animals ^ 2	-0.039	-0.037	0.042	0.043
	(0.56)	(0.51)	(1.19)	(0.99)
Plot level shocks				
Fraction of plot areas with rain shortage	-0.082	0.280	-0.353	-0.918
	(0.24)	(0.47)	(1.59)	(2.78)**
Fraction of plot areas with flood	0.990	1.033	0.286	0.207
	(1.95)	(1.95)	(0.92)	(0.55)
Fraction of plot areas with crop disease/	0.381	0.283	-0.119	-0.267
Insect problems	(0.96)	(0.64)	(0.43)	(0.78)
	Wereda dummies		Wereda dummies	
Constant	4.371	4.329	5.910	6.094
	(3.09)**	(2.94)**	(4.92)**	(4.20)**
Observations	349	349	758	758
R-squared	0.50	0.65	0.46	0.19

Note: * indicates significant at 5% level; ** indicates significant at 1% level. A) Endogenous variables; Instruments are 6 interaction terms between wereda mean food aid received in kg for FD and FFW and household characteristics (land holdings, value of animal holdings, and female head dummy). B) North region includes Tigray, North and South Gonder, East Gojjam, West Gojjam, Agewawi, North Wello, Wag Hamra, South Wello, North Shewa, and Oromiya. These are regions where people consume Sorghum and Teff.

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