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Reconciling Food-For-Work Objectives: Resource Conservation Vs. Food Aid Targeting in Tigray, Ethiopia

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Food-for-work (FFW) projects face the challenge of addressing three kinds of objectives: to feed hungry people, to build public works where needed, and to be feasible for prompt project implementation. In the debate over how to target FFW to the poorest of the poor, the last two program objectives are often overlooked. This research examines FFW afforestation and erosion-control programs in central Tigray, Ethiopia, during 1992-95 in order to examine how these sometimes conflicting objectives were reconciled.

The study decomposes the factors determining a household's FFW participation into three decision stages. First, at the regional level, project planners choose where to locate a FFW resource conservation project. Second, at the village level, a committee decides which villagers will be eligible to participate. Finally, the eligibile households may decide whether and how much to participate.

Using probit and truncated regression methods, the study finds that project implementation feasibility most influenced the probability that FFW projects would be available in the 25 villages surveyed. Among the 129 households in villages with FFW available, FFW eligibility was inversely related to household land area per capita and household size, results which are consistent with anti-poverty targeting. However, the model performed poorly at predicting non-eligibility for FFW, which suggests that anti-poverty targeting was not efficient. Among households eligible for FFW, those with greater resources (larger families that did not lease out land) tended to participate and supply more days of FFW labor than poorer households. The only households eligible for FFW which did not participate were unable (rather than unwilling) to do so, being comprised mostly of elderly women. Overall, anti-poverty targeting was sub-optimal but reasonable, given the feasibility constraint that these resource conservation projects to be sited in where labor and materials could be made available.

Reconciling Food-For-Work Objectives:

Resource Conservation Vs. Food Aid Targeting in Tigray, Ethiopia

by

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Using probit and truncated regression methods, the study finds that project implementation feasibility most influenced the probability that FFW projects would be available in the 25 villages surveyed. Among the 129 households in villages with FFW available, FFW eligibility was inversely related to household land area per capita and household size, results which are consistent with anti-poverty targeting. However, the model performed poorly at predicting non-eligibility for FFW, which suggests that anti-poverty targeting was not efficient.

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JEL Classification codes: Q18, O13.

Key words: Food-for-work; food aid targeting; Ethiopia; double-hurdle model.

Reconciling Food-For-Work Objectives:

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Governments throughout the world have been confronted with the challenge of ensuring adequate food to low-income consumers. Food assistance programs have been important in alleviating short-term food security problems of subsistence farmers in developing countries. However concerns have arisen regarding the degree to which such programs are targeted selectively to the poor, and the potential disincentive effects on food production incentives (Singer, 1989; Fitzpatrick and Storey, 1989; Lavy 1992; Webb, von Braun and Yisehac, 1992).

In response to these concerns, some governments have placed increased emphasis on alternative food transfer programs. Food-for-work (FFW) programs, which combine the two distinct goals of distributing food to the needy and constructing public works, have been the most common alternative food transfer mechanism. Although FFW programs are conceived under the assumption that the two goals can be compatible, there is no reason a priori that they must be. Food aid programs seek to target the needy; public works programs target able bodied workers in locations where public works are needed and feasible to construct. Hence there are both a logistical constraint and a design objective determining how well FFW can achieve the two sets of goals.

This paper analyzes the relationship between participation in FFW programs and indicators of poverty at the household level in Ethiopia. The results shed light on the extent to which FFW programs can effectively isolate food transfer benefits to the poor and exclude the non-needy,

thereby reducing the potential disincentive effects on domestic production. The paper examines the determinants of (1) location of FFW projects, (2) the selection of households eligible to participate in FFW programs, and (3) the factors that influence whether the household chooses to participate and how much effort it elects to contribute to FFW. Results for FFW participation during 1992-95 are based on a survey of 247 rural households from 30 villages in the Tigray region of Ethiopia. Purposive selection of villages followed by random selection of households ensured representation of the different agro-ecological zones.

Self-targeting food aid

Labor-intensive public works, if properly implemented, can effectively combine the objectives of employment generation for the needy and capital asset formation. Although programs differ in their emphasis on poverty alleviation, food security, and asset creation, the underlying goal of public works programs has been conceived in terms of simultaneously addressing these objectives (von Braun et al. 1991; Subbarao 1997). The challenge is to accomplish these objectives efficiently, in the sense of targeting project funds where they will accomplish the most. The rationale for targeting food aid is that if less needy households can be excluded, more food remains available for those who need it most.

Food assistance programs that "self-target" are desirable because they avoid the high costs of administering programs that seek to identify the poor and restrict benefits to them. "Self-targeting" projects are ones in which the poor choose to participate and the less poor choose not to do so. A commonly-used self-selection mechanism to increase the targeting efficiency of public

works has been to set a wage (cash or in-kind) that is low enough to make participation unattractive to any but the poorest (Ravallion and Datt, 1992). However, low wages can fail to target effectively for at least two reasons. First, even relatively wealthier households often include family members who are willing to work for low wages (Kebede et al. 1996). Second, since rural wage rates fluctuate seasonally, it may be difficult to establish a single wage that targets the poor effectively throughout the year. Basu (1982) has shown that if program wages exceed market wage rates for unskilled labor, then the ability to exclude non-needy households is compromised and job rationing is a likely outcome.

Design restrictions for resource conservation projects

Where FFW is directed toward resource conservation projects, two further design restrictions may complicate efficient food aid targeting. Common activities of resource conservation projects include afforestation, erosion control, and dam construction. Such projects impose biophysical and/or topographical conditions that may not coincide with the poverty objective of aid targeting. For example, dams must be built in valleys, yet valley floors often offer well-watered alluvial soils that may make for more prosperous farming communities. Likewise, terraces and bunds must be constructed on hill slopes, and trees must be planted where suitable land is available.

Apart from geophysical suitability, the location of resource conservation projects must also be logistically feasible. Many such projects call for heavy inputs such as rocks or tree seedlings rooted in soil. If large trucks or barges are needed to transport heavy inputs, the project

site must be accessible by road or waterway. But communities near transport routes are often more prosperous than isolated communities, so another potential conflict with anti-poverty targeting rears its head.

Food-for-work in Ethiopia

In Ethiopia, FFW was first used in public works programs in the early 1960's. By 1989, FFW projects had proliferated to the point where 75 small-scale projects were being operated by non-governmental organizations (NGO's) (von Braun et al., 1991). With the expansion of FFW, the Ethiopian government and foreign donors grew increasingly concerned about the country's growing dependence on food aid and accountability for its use (Sharp, 1997). A related concern was that large quantities of food aid, if poorly targeted, may depress market prices for food, discouraging domestic producers and undermining long-term food security (Maxwell et al., 1994).

The selection of FFW participants in Ethiopia has followed sharply different approaches. In the southern part of the former Shoa region, four NGO's used selection criteria that ranged from relatively objective measures such as poverty level and physical fitness, to selection by peasant associations, to a simple first-come-first-served basis (Kumar et al., 1993).

In the Tigray region, FFW programs during the 1990's have largely focused on natural resource rehabilitation. Extensive soil erosion over decades (Wood, 1989; Stahl, 1990) and extreme deforestation made hillside terraces and afforestation top priority activities in Tigray following the downfall of Ethiopia's military government in 1991. Natural resource conservation became the object of both organized community labor brigades as well as FFW projects. In

project villages, local committees decided which residents would be eligible to participate. Eligible households could then decide for themselves whether the daily food ration of 3 kilograms of wheat and 12 grams of vegetable oil per person-day was worth the effort.

This setting provides an opportunity to examine our key research question regarding "How compatible are the multiple objectives inherent in food aid targeting via resource conservation projects?" It seems plausible that the answer may vary along the chain of decisions which are taken before any household member lifts a shovel on an FFW public works project. Using household survey data from central Tigray in 1992-95, we examine 1) which factors determined the villages where FFW projects were located, 2) whether village committees effectively targeted the poor as eligible for FFW, and 3) which factors most affected whether and how much households chose to participate in FFW projects.

Conceptual model

The effectiveness of FFW targeting and the factors that affect level of participation are our primary areas of interest. Targeting effectiveness can be examined by evaluating the explanatory variables that appear to predict who participated. However, participation is determined at three distinct decision levels, as illustrated in Figure 1. First, regional governments and/or NGO's decide *where FFW projects will be located*. This decision is based on the multiple objectives of alleviating poverty and building such needed capital assets as stone terraces to reduce soil erosion or new forests to provide fuel supplies. The FFW project location decision is constrained by the imperative to find sites where necessary inputs and equipment can be delivered. Especially when

FFW projects are designed to respond to short-term food shortages, the logistical feasibility constraint can rule out locations that would require new roads in order to become accessible.

The second level decision in the Tigray context is taken by special committees in villages where FFW projects have been located. These village committees determine *whether a household is eligible* to participate in the project. The official objective is to limit eligibility to impoverished households. Because poverty was pervasive in Tigray during 1992-95, of interest is whether those *relatively* poorer households were more likely to be found eligible. Both the project location decision and the eligibility decision are exogenous to the household. However, if random disturbances are distributed normally, both decisions can be modeled as probit regressions. In particular, probit regression can address the question of which factors most affect the likelihood that a village is chosen for a FFW project – level of poverty, suitability for conservation investments, or logistical feasibility for project implementation. Likewise, probit can test the success of village committees at targeting FFW eligibility to the neediest households, by investigating whether household wealth or income per capita variables to predict eligibility (via an inverse relationship).

Only at the third level of FFW decision does the rural household get to make choices. These are the linked decisions over *whether to participate* and *how much effort to contribute* to a FFW resource conservation project. The participation decision can be modeled as an endogenous choice of household labor allocation. Focusing on the short-term decision about dry-season labor allocation to FFW, consider a farm household whose concave utility function ($U(z, l^e)$) is defined over consumption goods (z) and leisure (l^e). We assume that the household seeks to maximize

utility subject to the constraints that 1) the household budget is adequate, 2) its food needs (F) are met from food sources, including household stocks (f^0), FFW food (f^f) or purchased food (f^p), 3) the household labor supply equals the sum of wage labor (l^w), FFW labor (l^f), and leisure (l^e), and 4) the only available source of cash income (Y) is wage labor. (After the rainy season is over, agricultural work opportunities are assumed to be nil.) The household's constrained utility maximization problem is thus,

$$\max \; U(z, l^e)$$
$$s.t. Y \geq p_f f^p + p_z z$$
$$F \leq f^0 + f^f(l^f) + f^p$$
$$L = l^w + l^f + l^e$$
$$Y = w l^w$$

If households qualifying for FFW eligibility lack excess food, then we can assume that the food balance constraint is binding. With this proviso, the following Lagrangean function can be derived by substituting the food balance, labor supply and income identities into the constrained optimization equation, as follows:

$$\ell(z, l^e, l^f, l^w) = U(z, l^e,) - l(w[L - l^f - l^e] - p_f[F - f^f(l^f)] - p_z z$$

Taking first order conditions, the resulting optimality condition is

$$w = p_f \frac{\partial f^f}{\partial l^f} = \frac{\partial U}{\partial l^e}$$

which states that the wage rate (w, the marginal value of wage labor) should equal the marginal value of food earnings under FFW which, in turn, should equal the marginal utility of leisure.

This optimality condition implies that the household's supply of FFW labor is a function of the wage rate, the price of food, the marginal product of FFW, and the household's leisure preferences. As certain of these variables cannot be observed directly, inferences must be made by observing proxy variables. Moreover, since this model is for a single household, whereas cross-sectional data for testing the model will include households with differing levels of resources -- in knowledge, information, land and capital -- specification of an empirical model should also include such conditioning variables as wealth, education, and age.

Empirical model

The empirical analysis is conducted in the three stages identified in Figure 1. First, a probit regression examines what factors determined the availability of FFW projects at the village level. Second, for those villages where FFW was available, another probit regression examine factors affecting household eligibility for FFW. Third, for those households judged eligible for FFW, a "double hurdle" regression separately examines a) factors affecting the household's

choice to participate in FFW programs (probit regression), and b) factors affecting the decision by households that chose to participate on ow many days to devote to FFW work (Cragg, 1971; Haines et al., 1988; Greene, 1995).

The village-level FFW availability analysis included variables expected to affect both the need of the village for natural resource conservation, the village poverty level, and the feasibility of conducting them. Conservation need was measured by variables for average slope (a measure of erodibility) and proportion of households mentioning a fuel shortage (a measure of deforestation). Relative village poverty was loosely measured by average landholding and total households in village. Finally, logistical feasibility was measured by distance to nearest market town and distance to nearest paved road. It was expected that need for resource conservation and poverty would contribute to the probability of FFW conservation projects being available, while distance to market and paved road were expected to reduce project feasibility and hence availability.

Among villages where FFW was available, the probability that a household would be designated as *eligible* for FFW was expected to be a function chiefly of wealth and income per capita. The eligibility probit regression was estimated using the best proxies available for per capita wealth and income. Among several highly correlated wealth variables, those included were cultivable land per capita (LDPERCAP, created by dividing land holdings by household size), whether the household had "enough draft animal power for farming needs" (ENGHDRFT), whether it had access to credit (CRDTACS), and whether it used improved seed (SEEDIMP). Indirect indicators of income are whether a household member did off-farm work during the previous year

(OFARMWK) or purchased improved seed (SEEDIMP). All six wealth and income variables were expected to reduce the probability of eligibility for FFW. A variables indicating household need level was whether it leased out land (LDLSEUT, often an indicator of inadequate resources to cultivate) which was expected to enhance FFW eligibility. Household size (SZEHSHD) was included without prior expectation as to direction of influence on eligibility, since it can be viewed as either an asset (income-earning capacity, hence a form of wealth) or a need (more mouths to feed, hence a form of poverty). Finally, literacy of household head (LITHSHED) was employed as a conditioning variable, with the expectation that better educated household heads would more successfully qualify for FFW.

The double hurdle analysis of FFW participation begins with a probit regression to examine factors that affect whether or not eligible households choose to participate. The binary dependent variable PARTICIPATE indicates whether or not eligible households participated in a FFW program. The influence of the explanatory variables included will differ from the eligibility regression because a new element enters now: the ability of eligible households to provide the labor necessary for FFW. Hence, household size is now expected to increase the probability of participation. Off-farm work is expected to decrease participation because it competes with FFW for available work time. Other wealth and income variables are again expected to reduce the likelihood of participation due to less need. As before, leasing out land indicates greater need and so is expected to enhance participation, as is literacy of household head.

We apply a truncated regression to examine the decision on how much household labor is supplied to FFW projects from those households that chose to participate. The truncated

regression is applied to the household observations where the dependent variable, DAYSWKD, was non-zero. Variables included were the same as those in the probit model, since the theoretically desirable variables in Equation (2) (wage rate, food price, marginal product of FFW, and the household's leisure preferences) either did not vary across households in the survey or else were unobservable. Initial expectations were that regression coefficient signs would be similar to the participation probit regression, but magnitudes would differ.

Results and discussion

The results are presented hierarchically. We begin with the factors affecting the availability of FFW projects in the study zone. In villages where FFW was available, we proceed to examine the factors that affected eligibility of households. Among those households determined by the local community groups to be eligible, we then look into factors that affected the choices on whether and how much to participate.

Availability of FFW projects

Before FFW targeting can be examined, FFW projects must exist. This research could not directly observe the feasibility of different location for FFW. It could, however, examine which of the 25 villages studies had FFW conservation public works projects available. The probit regression (Table 1) had weak explanatory power, but its chi-square statistic was significant at the five percent level. Only the feasibility variables were significant (at the 10% threshold), indicating that distance to both market and paved road both detracted from the likelihood that a village

would have FFW a conservation project available. This result supports the hypothesis that feasibility factors are more important than any poverty targeting factors in determining where FFW resource conservation projects are located. Equally important, neither of the two conservation need criteria (average slope and wood fuel shortage) proved important for siting FFW projects.

Eligibility for FFW

In the areas where FFW programs were operational, about 80% of households were likely to have been eligible for participation, as that many failed to be self-sufficient in food from their own production (Relief Society of Tigray, 1995). The eligible percentage in the survey sample was similar, as shown in Table 2. Although the differences are not statistically significant, ineligible households held more land and were more likely to participate in off-farm work than eligible ones (Table 2). Ineligible households were also less likely to claim that they had enough draft power. The data do not allow us to determine whether this was because their larger farms required more draft power or because they actually owned fewer draft animals.

The probit regression for eligibility to participate in FFW (Table 3) did an excellent job of correctly predicting eligibility, but a very poor one of predicting ineligibility. Household size, per capita cultivated land and availability of adequate draft animal power were significant variables, with the first two having the expected signs. Larger households and those with more cultivated land per capita were less likely to be selected as eligible. The positive coefficient on availability of enough draft power might be explained by the fact that those who participate have less cultivated

land per capita which requires less draft power. Literacy of households, off-farm work, access to credit, and use of improved seed all had the expected signs but were insignificant. The negative coefficient on land lease practice is consistent with the positive coefficient of availability of enough draft power. Since agricultural land in central Tigray is distributed based partly on household size, eligible households have less land available per capita, which may cause them to lease out land less frequently.

The correlation between days worked at FFW and days worked at off-farm activities was very low but positive (r= 0.12). This suggests that participation in FFW does not compete with off-farm employment. Income obtained from off-farm employment was also only weakly associated with days worked in FFW, although the correlation was negative (r= -0.16), suggesting that those who did less FFW worked earned more from off-farm activity. The ineligible households were about equally divided between those who did and did not participate in off-farm work. However, only one-third of the eligible households reported off-farm work.

Participation in FFW conservation projects

What motivated eligible households to participate in FFW? Of those households which were eligible, more than 90% actually participated in FFW programs (Table 2). Compared with the households that participated in FFW, those who were eligible but did not participate tended to be small households headed by elderly women who had significantly less land per capita, lacked adequate draft power, and leased out their fields (Table 2).

Both the probit regression on whether eligible households *chose to participate* in FFW (Table 4) and the truncated regression on the *extent of participation* (Table 5) gave similar results. Whereas household size detracted from eligibility, among eligible households, larger ones are more likely to participate in FFW and larger households that do participate put more person-days into FFW. Leasing out land tends to detract significantly from the probability of participating in FFW. Both significant variables are highly correlated with two variables omitted due to multicollinearity: age and sex. In Table 3, these variables highlighted the sharply different characteristics of those households headed by elderly women who could not participate in FFW.

Summary and Conclusions

The multiple objectives inherent in food-for-work projects cannot all be optimized at once. Results from this study of FFW resource conservation projects in central Tigray during 1992-95 suggest that logistical feasibility chiefly determines where FFW conservation projects were located. Perhaps because the problems of deforestation and soil erosion are so widespread, these natural resource need criteria did not play an important role in project siting. However, where FFW projects were available, the village committees were fairly effective at targeting the poorer households as eligible.

Among eligible households, the decision to participate in FFW appears to be determined by ability rather than desire to participate. The households that did not participate were chiefly those of elderly women who were unable to do the work. This implies two things. First, the daily food ration was apparently higher than the reservation wage of most households when these FFW

programs were operating. Second, the eligible households that did not participate were constrained by inability to do the work. This result suggests that such households require special treatment with regard to food assistance. As it happened, 20 percent of food aid distributed by the Relief Society of Tigray was donated free to those who could not participate in development activities -- specifically households like these.

Food-for-work programs in central Tigray were apparently effective at reaching the poorer strata of the population, within the limitations of logistical feasibility. Our results highlight the trade-offs necessary to reconcile such multiple program objectives as addressing the areas of greatest resource deterioration, reaching the poorest households, and feasibly meeting the logistical challenge to delivering labor and supplies where needed. At the same time, this study points to the importance of special safety net programs for those who are food insecure but too infirm to participate in labor-demanding FFW activities.

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Table 1: Results of probit regression on factors affecting availability of Food-for-Work projects in 25 Tigray villages during 1992-95.

Variable	Coefficient estimate	Asymptotic z-statistic
Constant	2.644	0.99
Distance to market (km)	-0.959	-1.88 *
Distance to paved road (km)	-0.599	-1.77 *
Average slope (degrees)	0.113	0.72
Average size of land holding (ha)	0.211	0.43
No. of households in village	0.003	1.04
Wood fuel shortage (0/1)	-1.617	-1.07

N = 25; χ^2 (6) = 12.7; Prob > χ^2=0.05; Log likelihood function =-53.09

* Denotes coefficient significantly different from zero at 10% probability.

Table 2: Household characteristics by FFW eligibility and participation status

Variable definition	Variable name	Eligible for FFW		Not Eligible for FFW (n=26)
		Participated (n=103 to 109)	Did not participate (n=7 to 9)	
Mean land area (ha)	LANDSIZE	1.56 (1.15)*	0.53 (0.48)	2.18 (1.23)
Mean household size	SZEHSHD	4.69 (1.97)	1.67 (1.12)	5 (1.90)
Mean age of household head	AGEHSHD	44.97 (14.56)	61.89 (7.79)	46.46 (12.31)
Percent female-headed households	FEMALE	12	77.8	11.5
Percent literate household heads	LITHSHED	26.6	0	23.1
Percent participation in off-farm work	OFF-FARM	35.2	0	53.8
Percent access to ag. credit	CRDTACS	31.2	33.3	30.8
Percent leasing out land	LDLSEUT	19.5	88.9	26.9
Percent with enough draft power	ENGHDRFT	44	11.1	30.8
Percent with adequate local seed	LCLSEED	59.4	50	57.7

* Standard deviations are in parentheses for the continuous variables.

Table 3: Results of probit regression on eligibility for participation in FFW programs, 129 Tigray households, 1995.

Variable	Coefficient estimate	Asymptotic z-statistic
Constant	2.636	4.52 ***
Household size (persons)	-0.153	-1.97 **
Literacy of household head (0/1)	0.265	0.77
Off-farm work (0/1)	-0.310	-1.04
Access to credit (0/1)	-0.070	0.22
Land leased out (0/1)	-0.403	-1.09
Adequate draft power available (0/1)	0.856	2.32 **
Improved seed used (0/1)	0.116	0.34
Land per capita (ha/person)	-3.214	-3.52 ***

χ^2 (8) = 20.7; Log likelihood function =-53.09.
Correctly predicted eligibility: 98%; non-eligibility: 12%.

* Denotes coefficient significantly different from zero at 10% probability.
** Denotes coefficient significantly different from zero at 5% probability.
*** Denotes coefficient significantly different from zero at 1% probability.

Table 4: Results of probit regression on participation in FFW programs by 105 FFW-eligible Tigray households, 1995.

Variable	Coefficient estimate	Asymptotic z-statistic
Constant	-0.366	-0.25
Household size (persons)	1.043	1.75 *
Off-farm work (0/1)	5.931	0.10
Land leased out (0/1)	-3.527	-2.30 **
Improved seed used (0/1)	4.944	0.08
Land per capita (ha/person)	0.187	0.06

N.B. Due to collinearity problems, the literacy, credit access and draft power variables were omitted from the regression.

χ^2 (5) = 41.5; Log likelihood function =-5.04
Correctly predicted participation: 99%; non-participation: 71%.

* Denotes coefficient significantly different from zero at 10% probability.
** Denotes coefficient significantly different from zero at 5% probability.

Table 5: Results of truncated regression on days worked on FFW by 91 participating households, Tigray, 1995.

Variable	Coefficient estimate	Asymptotic z-statistic
Constant	-647.47	-1.31
Household size (persons)	88.71	1.79 *
Literacy of household head (0/1)	251.42	1.54
Off-farm work (0/1)	39.45	0.35
Access to credit (0/1)	124.25	0.95
Land leased out (0/1)	-337.46	-1.23
Adequate draft power available (0/1)	-97.08	-0.75
Improved seed used (0/1)	2.67	0.02
Land per capita (ha/person)	-314.66	-0.86
σ	221.75	69.34

Log likelihood function = -517.61

* Denotes coefficient significantly different from zero at 10% probability.

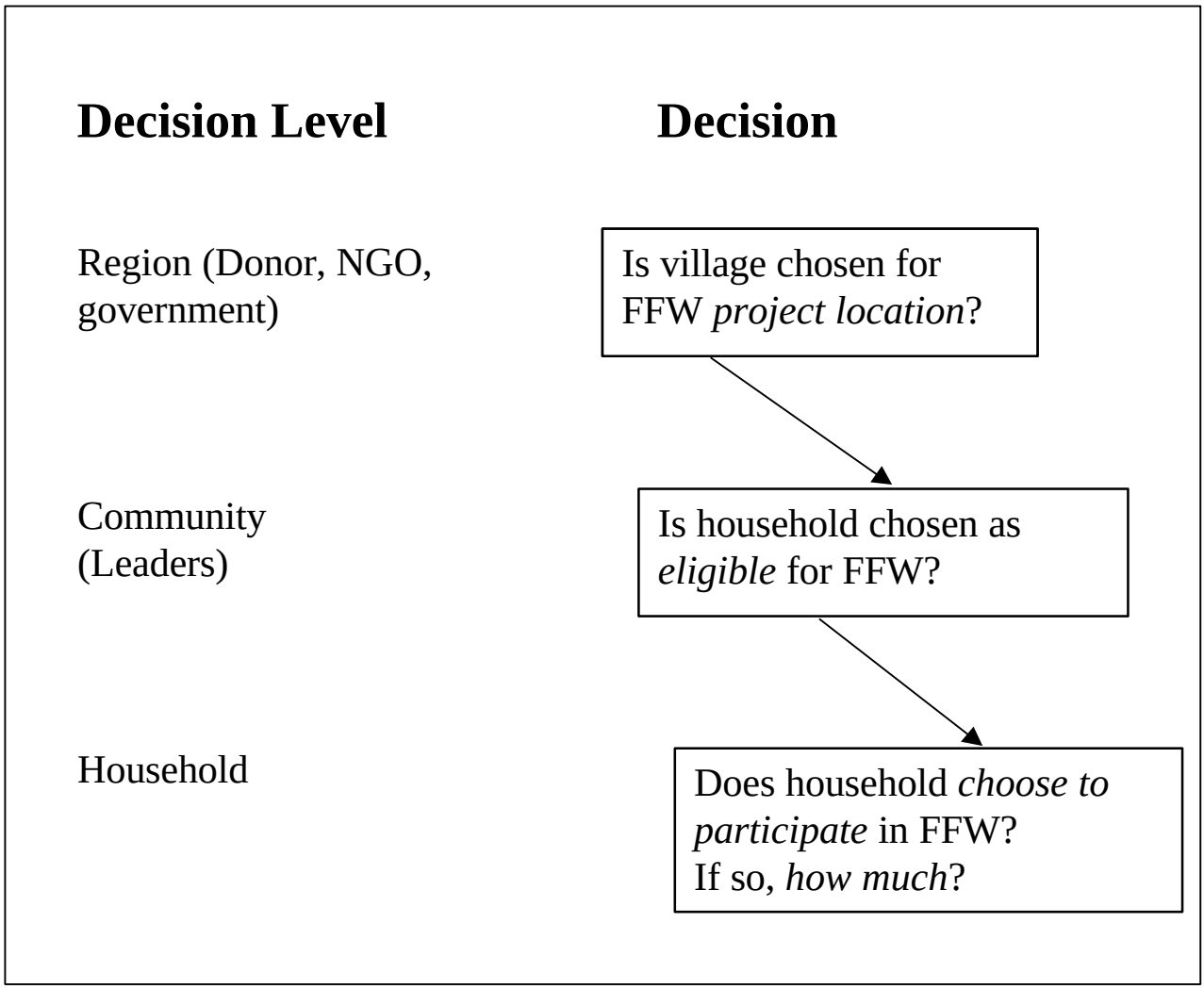

Figure 1: Sequence of decisions affecting household participation in food-for-work projects in Tigray, Ethiopia.