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Food Aid Impact on Poverty Reduction: Empirical Evidence from Rural Households in Ethiopia

Mulubrhan Amare Reda
Germán Calfat



University
of Antwerp



INSTITUTE OF DEVELOPMENT
POLICY AND MANAGEMENT

Comments on this Discussion Paper are invited.
Corresponding author: german.calfat@ua.ac.be

Instituut voor Ontwikkelingsbeleid en -Beheer
Institute of Development Policy and Management
Institut de Politique et de Gestion du Développement
Instituto de Política y Gestión del Desarrollo

Postal address:	Visiting address:
Prinsstraat 13	Lange Sint-Annastraat 7
B-2000 Antwerpen	B-2000 Antwerpen
Belgium	Belgium

Tel: +32 (0)3 265 57 70
Fax: +32 (0)3 265 57 71
e-mail: dev@ua.ac.be
<http://www.ua.ac.be/iob>

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Mulubrhan Amare Reda *
Germán Calfat**

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* PhD candidate at IOB and the The Faculty of Applied Economics , University of Antwerp and lecturer at Mekelle University, Department of Natural Resource Economics and Management, Ethiopia.

** Germán Calfat is lecturer at IOB and member of the thematic group Impact of Globalisation.

TABLE OF CONTENTS

	ABSTRACT	6
	RÉSUMÉ	7
1.	INTRODUCTION	9
2.	CONCEPTUAL FRAMEWORK AND EMPIRICAL EVIDENCES	11
3.	ANALYTICAL APPROACHES	13
3.1.	Impact evaluation problem	13
3.2.	Difference-in-differences propensity score matching and switching regression	13
3.3.	Poverty analysis	16
4.	RESEARCH SETTINGS AND POVERTY PROFILE	17
4.1.	Data sources	17
4.2.	Poverty profiles and decomposition	17
4.3.	Regional decomposition based on targeting efficiency indicators	20
5.	ECONOMETRICS RESULTS: IMPACT EVALUATION AND DETERMINANTS OF WELFARE GROWTH	23
5.1.	Difference-in-differences propensity score matching	23
5.2.	Average impact of participation in FFW/FFD programs	26
5.3.	Switching model results: determinants of welfare growth	27
5.4.	Switching model results: impact of FFW and FFD program intervention	28
6.	CONCLUSION	29
	REFERENCES	31
	ANNEX I: DETERMINANTS OF WELFARE GROWTH: SWITCHING MODEL FOR FFW AND FFD PARTICIPANTS AND NON-PARTICIPANTS	34

ABSTRACT

Ethiopia is one of the highest food aid recipient countries in the Sub-Saharan Africa region. Despite the magnitude of the aid, its impact as development resource is inconclusive in both theoretical and empirical evidences. This paper evaluates the impact of food aid on poverty reduction making use of an Ethiopian rural longitudinal household survey data (ERHS) primarily collected in 1999 and 2004, with the purpose to add empirical evidences on the existing debate on food aid. Besides, it deals with the correlation of poverty assets which has fundamental importance for policy implication and the choice of appropriate development strategies.

We used separate regressions on determinants of welfare growth for food-for-work (FFW) and free-food-distribution (FFD) programs. The results show that access to information, initial endowment, household characteristics, and shocks were the main determinants of escaping from poverty and food aid dependence. The results from the poverty profile, difference-in-differences matching and switching regression support the fact that participation in FFW or FFD programs reduces poverty. However, some indicators from the analysis showed that both FFW and FFD programs have targeting efficiency problems and differ across regions, which indicate that there is room for improvement in the distribution of food aid through targeting the poorest and geographically based intervention linked with productive investment.

Key Words: *Ethiopia, food-for-work (FFW), free-food-distribution (FFD), welfare growth, difference-in-differences propensity score matching, endogenous switching regression.*

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RÉSUMÉ

L'Éthiopie est un des pays recevant la plus importante aide alimentaire dans la région subsaharienne. En dépit de l'envergure du soutien, l'impact de l'aide en tant que facteur de développement n'est que peu concluant tant en théorie qu'en pratique. Cet article contient une évaluation de l'impact de l'aide alimentaire dans la lutte contre la pauvreté, basée sur une enquête longitudinale auprès de ménages éthiopiens ruraux (ERHS) menée en majeure partie en 1999 et 2004, afin d'apporter des preuves empiriques au débat actuel sur l'aide alimentaire et afin de rappeler l'écart entre la corrélation et la causalité concernant l'évaluation des effets des programmes. La corrélation des facteurs de pauvreté déterminants pour les résultats de la politique et le choix de stratégies adéquates de développement sera elle aussi exposée.

Nous avons appliqué différentes régressions sur des facteurs décisifs pour l'accroissement du bien-être dans le cadre de programmes vivres contre travail et de distribution alimentaire gratuite. Les résultats démontrent que l'accès à l'information, les moyens initiaux, les caractéristiques des ménages et les chocs étaient les principaux facteurs permettant d'échapper à la pauvreté. Les résultats du profil de pauvreté, l'estimation de la différence de différences et les régressions avec variables d'écart étaient la thèse que la participation aux programmes de vivres contre travail et de distribution alimentaire gratuite soutient l'accroissement du bien-être. Cependant, plusieurs indicateurs de l'analyse ont démontré que les deux types de programmes ont un ciblage inefficace et présentent des différences régionales, ce qui implique que la distribution d'aide alimentaire est susceptible d'améliorations par le ciblage des plus démunis et une intervention différenciée par région, en lien avec des investissements productifs.

Mots clés : *Éthiopie, vivres contre travail, distribution alimentaire gratuite, accroissement du bien-être, estimation des scores de propension différence de différences, modèles de régression avec variables d'écart*

1. INTRODUCTION

Ethiopia is one of the biggest food aid recipient countries in Africa. The country receives between 20 and 30 % of all food aid to sub Saharan Africa (Bezu and Holden, 2008). The FFW (food-for-work) program is a public work program which is designed to provide employment for able-bodied people affected by disaster or severe food shortages by allowing households to participate in public investments. A household is entitled to FFD (free-food-distribution) if it does not qualify to participate in the FFW program due to age limitations or particular disabilities (Gilligan and Hoddinot, 2007; Barrett et al, 2003).

For nearly four decades, there has been considerable debate regarding the possible effects of food aid on agricultural production and consumption behaviour in the recipients countries. However, the discussion on the impact of food aid as a development resource has not been finally settled yet neither theoretically nor empirically. The critics argue that food aid encourages governments to neglect and/or postpone agricultural production and investment; inducing a change in the consumer preferences from local to imported goods. It can also create economic and political dependence; which, all in all, directly and indirectly affects the domestic production and poverty. The empirical evidence (e.g. Gelen, 2006; Demeke et al., 2006) provides a strong case in support of the disincentive hypothesis of food aid effect.

Proponents of food aid, on the other hand, argue that particularly project and emergency food aid play a vital role in feeding the poor, saving lives, enabling countries to achieve economic growth and greater social equity. In other words, food aid can increase resources for current consumption and capital accumulation; increase and improve the nutritional and health status and educational levels of the poor. Thus, by directly alleviating hunger and poverty, and adding to human capital, food aid serves as a wage for the poor. Empirical evidences (e.g. Gilligan and Hoddinot, 2007; Barrett et al, 2003) show that timely food aid distribution responses to shock play an important role in reducing vulnerability and protecting assets.

Empirical evidence in this regard is scanty to guide and understand the impact of food aid on poverty reduction. This study assesses the impact of food aid on poverty in selected villages in rural Ethiopia by employing techniques, such as: switching regression model and difference-in-differences propensity score matching. These methods tackle a major challenge in selection bias, missing data problem, and impact evaluation of programs. Applying both methods in evaluating the impact of food aid make it possible to attribute causation of poverty reduction gains of food aid. This represents the main contribution of this paper to the existing literature on food aid debate and its impact evaluation measurement.

The poverty reduction policies and strategies in Ethiopia have focussed on enhancing productivity of smallholder farmers, provision of inputs and credit supply, building of infrastructure expansion of primary education and health care services (Hagos and Holden, 2005). Therefore, dealing with the correlation of poverty with household socio-economic characteristics and other factors are of fundamental importance in dealing with policy implication and choice of development strategies.

This study has three main objectives. First, it assesses trends in poverty, identifies determinants of poverty and also undertakes poverty profiles decomposition based on FFW,

FFD program participation and asset holdings. Second, it aims to identify the main factors that affect participation of households in FFW or FFD program, and attempts to examine the targeting efficiency of FFW and FFD program. Third, by employing a combination of parametric and non-parametric regression methods such as difference-in-differences propensity score matching and switching regression, the study examines the impact of FFW and FFD program participation on poverty reduction which attributes causation of poverty reduction gains of food aid.

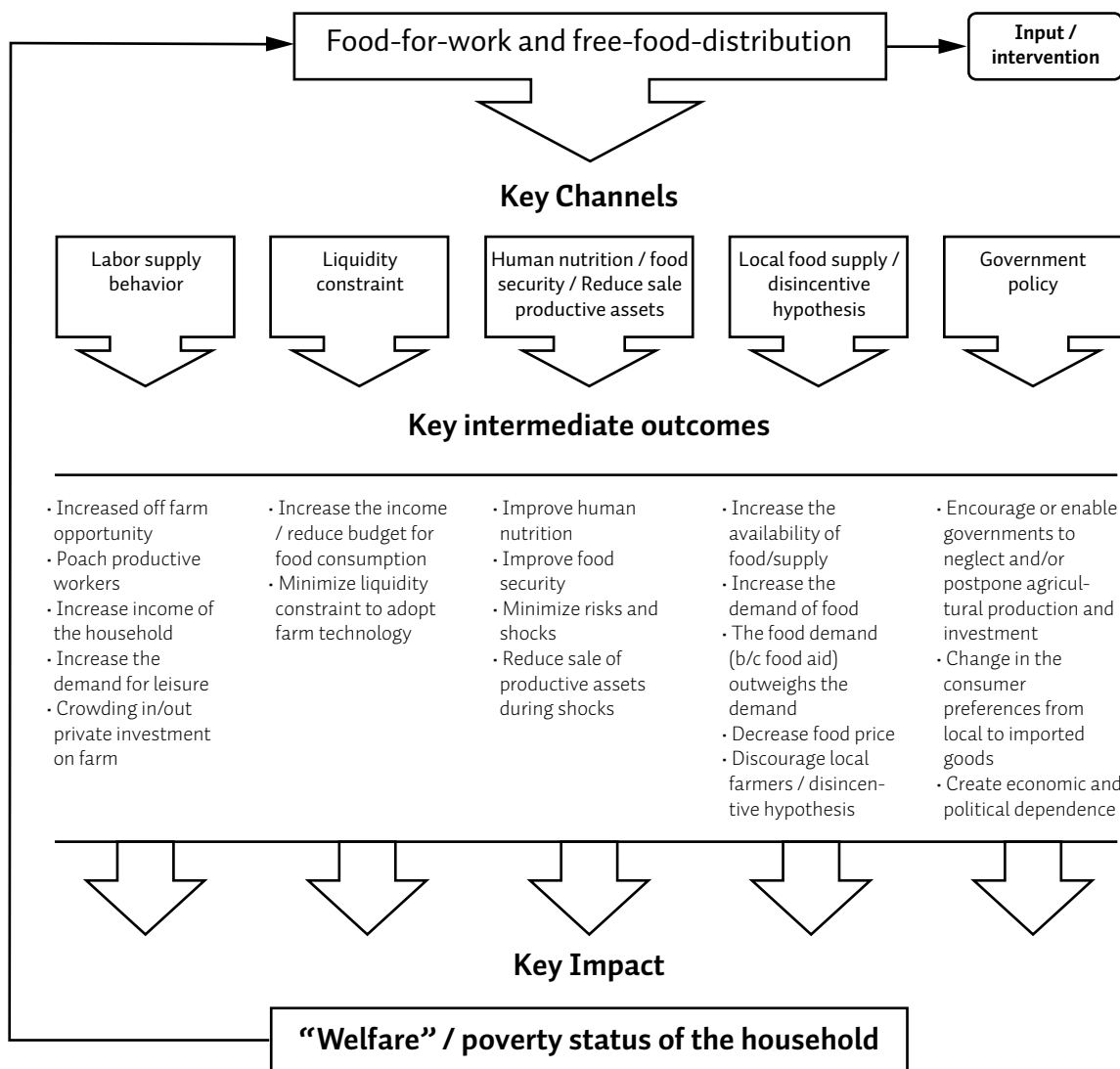
The remainder of this paper is organized as follows. Section 2 reviews both the conceptual framework and empirical evidences on the food aid debate. The empirical challenges and research settings are presented in section three. Section four presents poverty profiles and econometric analysis. Econometric results on impact evaluation and determinants of welfare growth are discussed in section 5. Finally, conclusion and policy implications are presented in section 6.

2. CONCEPTUAL FRAMEWORK AND EMPIRICAL EVIDENCES

The debate on the impact of food aid as development resource can be explained through several conduits by its effect on the labor supply, liquidity constraint, human nutrition/food security, local production and government policy (Fig.1). A great deal of the literature on the critics of food aid is explained using the disincentive hypothesis developed by Shultz (1960). The disincentive hypothesis argues that food aid inflow increases domestic food supply; and thus shifting the supply curve to the right, bringing prices down as a result. Consequently, food aid depresses local production as a result of lower prices paid to the farmers (Trap, 2000; Barrett, 2001; Barrett, 2006). Some studies (see Demeke et al, 2006; Gelan, 2006 in Ethiopia) suggest that food aid displaces domestic production and commercial trade by depressing prices in the recipient countries; it affects the labor supply negatively, enhance market imperfections and information asymmetries and this in turn affects economic development (Demeke et al, 2006; Gelan, 2006).

However, Barrett (2001) pointed out that the magnitude of the displacement of local production will be very low as long as the food aid distribution targets the poor who have high income elasticity of demand for food. Besides, domestic producers may keep and increase their production even when food aid decreases the prices of their output in the market, provided that the fall in the input price exceeds the fall in the product prices (Abdulai et al., 2004). For example some studies (Abdulai et al, 2004) critically looked at the disincentive hypothesis of the food aid in Ethiopia. Their result advocated that food aid increases supply of labor to the agriculture sector, wage work and own business activities, in addition, the paper also verified that net positive impact of food aid as development resource. Besides, Gilligan and Hoddinott (2007) dealt with the impact of emergency food aid on asset holding, food security and consumption in Ethiopia. Their results suggest that emergency food aid played an important role in improving welfare, access to food, and food security for many households.

Figure 1. Summary of the possible channels on how FFW and FFD distribution affect welfare/ poverty reduction



The possible unintended outcome of FFW is poaching agricultural workers from the farm especially when the wage rate paid for FFW is higher than the prevailing wage rate in the market and this reduces the labor hour supply to production which in turn reduces agricultural production (Barrett, 2002; Abdulla, et al, 2004; see Fig.1). On the other hand, FFW may contribute in supplementing public programs investment, by allowing the poor and able household to participate in constructing free feeder road, reforestation and soil water conservation. This in turn may improve market access and agricultural production (Abdulla, et al, 2004; Holden et al, 2006). Holden et al, (2006) examined the crowding in and crowding out effect of food aid on private investment of farm households in Northern Ethiopia. The result indicated that investment in natural resources and resource conservation using FFW projects have stronger crowding in effect than crowding out effect.

3. ANALYTICAL APPROACHES

In this section we present the impact evaluation problem, estimation methods to measure the food aid impact on poverty reduction and poverty analysis.

3.1. Impact evaluation problem

Estimation of the 'welfare' gain of food aid based on non-experimental observations is not trivial. What we cannot observe is the welfare growth for participants in FFW/FFD programs, in case they didn't participate. That is, we do not observe the welfare growth of households that received food aid had they not had received it. In experimental studies, this problem is addressed by randomly assigning food aid to treatment and control status, which assures that the welfare growth observed on the control households without food aid are statistically representative of what would have occurred without food aid.

However, food aid is not randomly distributed to two groups of the households (as receipts and as non receipts), but rather the households themselves deciding to participate and/or are systematically selected by administrators based on their propensity to participate in getting food aid. Therefore, participants and non-participants in FFW/FFD programs may be systematically different; this difference may manifest themselves in differences in poverty status that could be mistakenly attributed to FFW/FFD programs.

Thus, it is difficult to perform ex-post assessment of gains from food aid using observational data, because of possible selection bias due to observed and unobserved household characteristics (Kassie et al, 2007). Failure to account for this potential selection bias could lead to inconsistent estimates of the impact of FFW/FFD programs. In other words, this bias occurred when there are unobservable characteristics that affect both the probability of participation in the program and the outcome variable, welfare growth. The possible source of this bias is the existence of unobservable characteristics of the program participants (Gilligan and Hoddinott, 2007).

The most appropriate methods to mitigate the selection bias problems are two stage switching regression and difference-in-differences propensity score matching methods (see Rosenbaum and Rubin, 1983 for detail). We use both approaches to check the robustness of our results and discuss in the next sections.

3.2. Difference-in-differences propensity score matching and switching regression

Following Rosenbaum and Rubin (1983), Green (1997) and Angrist (2001), different econometric techniques are applied to correct for potential bias in estimating the impact of program participation on the household welfare growth outcomes. Following, Heckman, Ichimura, and Todd (1997), let Y_1 be the value of welfare when the household i is subject to treatment ($P = 1$) and Y_0 the same variable when it does not participate in the program ($P = 0$). The observed welfare is

$$Y = PY_1 + (1 - P)Y_0 \quad (1)$$

When ($P = 1$) we observe Y_1 ; when ($P = 0$) we observe Y_0 . The average effect of treatment on the treated (ATT) is defined as

$$ATT = E(Y_1 - Y_0 | P = 1) = E(Y_1 | P = 1) - E(Y_0 | P = 1) \quad (2)$$

We can only observe the outcome variable of participants $E(Y_1 | P = 1)$; however, we cannot observe the outcome of participation had they not participate $E(Y_0 | P = 1)$. Therefore, matching estimation assumes counterfactual analysis, by matching treatment and control. The primary assumption underlying matching estimators is the Conditional Independence Assumption (CIA). CIA states that the decision to participate is random conditional on observed covariates X (Wooldridge, 2002). In notation,

$$(Y_1, Y_0) \perp P | X \quad (3)$$

This assumption implies that the counterfactual welfare indicators in the treated group is the same as the observed welfare growth for non-treated group

$$E(Y_0 | X, P = 1) = E(Y_0 | X, P = 0) = E(Y_0 | X) \quad (4)$$

This assumption rules out adoption on the basis of unobservable gains from food aid participation. The CIA requires that the set of X 's should contain all the variables that jointly influence the welfare indicators with no-treatment as well as the selection into treatment. Under the CIA, ATT can be computed as follows:

$$ATT = E(Y_1 - Y_0 | X, C = 1) = E(Y_1 | X, C = 1) - E(Y_0 | X, C = 1) \quad (5)$$

Matching the participants based on observed covariates might be complicated when the set of covariates is large. In order to reduce the curse of dimensionality, Rosenbaum and Rubin (1983) suggested instead of matching along X , one can match along $P(X)$, a single index variable that summarizes covariates. This index is known as propensity score (response probability - PS). It is the conditional probability that the households i participate given covariates:

$$p(X) = pr(P = 1) | X \quad (6)$$

The ATT in equation (15) can then be written as

$$ATT = E(Y_1 | P(X), P = 1) - E(Y_0 | P(X), P = 1) \quad (7)$$

More specifically, the ATT is the difference between two terms with the first term being the welfare growth for the treated group which is observable and the second term being the welfare growth for the treated group had it not been treated, representing a counterfactual situation which is unobservable and needs to be treated. Since PS is a continuous variable, exact matches will rarely be achieved and a certain distance between treated and untreated households has to be accepted. To solve this problem, treated and control households are matched on the basis of their scores using nearest neighbor and kernel methods matching estimators.

Despite the fact that propensity score matching tries to compare the difference between the outcome variables of adopters and non-adopters with similar inherent characteristics, it cannot correct unobservable bias because propensity score matching only controls for observed variables (to the extent that they are perfectly measured). Difference-in-difference matching estimator removes any bias due to unobservable, time-invariant differences between

the treatment and comparison group (See Gilligan and Hoddinott, 2007 for detail). Difference-in-differences measured $[Y_{1a} - Y_{1b}|P = 1] - [Y_{0a} - Y_{0b}|P = 0]$ where the subscripts 'a' and 'b' denote *after* and *before* the experiment occurs and '1' and '0' denote participant and non-participant. Therefore, equation 2 above can be improved by subtracting the preprogram welfare growth for both the matched participants and non-participants.

$$ATT = [Y_{1a} - Y_{1b}|X, P = 1] - [Y_{0a} - Y_{0b}|X, P = 0] \quad (8)$$

We also complement difference-in-differences propensity score matching estimates with two-stage switching regression model to check the robustness of the result. Two-stage switching regression can be used to address unobservable selection bias as the result of matching during impact evaluation. The model can be exogenous and endogenous. Following, Maddala and Nelson (1975) and Laure (2007) this paper uses the endogenous switching regression model.

Consider household welfare growth Y_{1i} for participant in FFW/FFD program and Y_{0i} for not participant. Let X_{1i} and X_{0i} be $1 \times n_1$ and $1 \times n_0$ vectors of explanatory variables relevant to each group. Let β_1 and β_0 be $n_1 \times 1$ and $1 \times n_0$ conformable individual specific parameter vectors and γ a $m \times 1$ parameter vector. We do not impose $\beta_1 = \beta_0$ as the outcome variables status to certain characteristics may be individual specific. Let also P be a latent variable determining which group applies, (z_{ip} a $1 \times m$ vector of vector of explanatory variables assumed to explain the probability of participation in the program (see Ravallion, 2003 for detail). Finally, let u_{ip} , ε_{1ip} and ε_{0ip} be error terms. Switching-regression can all be defined by the following set of equations,

$$P_{ip} = 1(z_{ip}\gamma + u_{ip} > 0) \quad (9)$$

$$Y_{1ip} = X_{1i}\beta_1 + \varepsilon_{1ip} \text{ if } P_{ip} = 1 \quad (10)$$

$$Y_{0ip} = X_{0i}\beta_0 + \varepsilon_{0ip} \text{ if } P_{ip} = 0 \quad (11)$$

Equations (10) and (11) describe the relationship between the variables of interest in each of two regimes, whereas (9) is a selection equation determining which regime applies. ε_{1ip} , ε_{0ip} and u_{ip} are idiosyncratic error terms assumed to be trivariate normally distributed with mean zero. Since individuals are observed either in state $P_{ip} = 1$, or in state $P_{ip} = 0$, but never in both, the covariance of equation 10 and 11 is equal to zero.

The conditional expectation of the outcome variables equations (10 & 11) assuming that $E(u_{ip}^2) = 1$ are defined as

$$E(Y_{1ip}|x_{ip}, P_{ip} = 1) = x_{ip}\beta_1 + \vartheta_1\lambda_1(z_{ip}\gamma) \quad (12)$$

$$E(Y_{0ip}|x_{ip}, P_{ip} = 0) = x_{ip}\beta_0 + \vartheta_0\lambda_0(z_{ip}\gamma) \quad (13)$$

where $\lambda(\cdot)$, is the inverse mill's ratio defined as $\lambda_1 = \frac{\phi(z_{ip}\gamma)}{\Phi(z_{ip}\gamma)}$ for positive observations ($P_{ip} = 1$) and $\lambda_0 = -\frac{\phi(z_{ip}\gamma)}{1 - \Phi(z_{ip}\gamma)}$ for the zero observations ($P_{ip} = 0$) where ϕ and Φ are the

probability density function (pdf) and cumulative distribution functions(cdf) of the standard normal variable, respectively.

Equation (12) and (13) are defined to be endogenous switching regime model, and when $\vartheta_1 = \vartheta_0 = 0$ these equations simplify to exogenous switching regime model, where ϑ_1 is the covariance of ε_{1ip} and u_p and ϑ_0 is the covariance of ε_{0ip} and u_p . The residuals from (12) and (13) cannot be used to determine the variance-covariance matrix of the two-stage estimates since λ_1 and λ_0 are generated regressors. Standard errors in the second stage are corrected by bootstrapping both outcome and participation equations. The mean outcome variable, welfare growth, difference between participants and non-participants can be estimated as:

$$E(Y_{1ip}|x_{ip}, C_{ip} = 1) - E(Y_{0ip}|x_{ip}, C_{ip} = 1) = x_{ip}(\beta_1 - \beta_0) + \vartheta_1\lambda_1 - \vartheta_0\lambda_0 \quad (14)$$

The second term in the left-hand side of (14) is the expected value of Y if the household had not participated in the program.

3.3. Poverty analysis

When estimating poverty following the money metric approach, one may have a choice between using income or consumption as the indicator of well-being. Most analysts argue that, provided the information on consumption obtained from a household survey is detailed enough, for many reasons, consumption will be a better indicator of poverty measurement than income for many reasons (Coudouel et al. 2002). Hence, in this paper we estimate poverty profiles using expenditure adjusted for differences in household characteristics. We also used the Foster-Greer-Thorbecke (FGT) class of poverty measures to calculate poverty indices (Foster et al., 1984). The FGT class of poverty measures has some desirable properties (such as additive decomposability), and these measures include some widely used poverty indices (such as the head-count and the poverty gap measures). Following Duclos et al. (2006), we also calculated the relevant values of P_0 , P_1 , and P_2 . P_0 measures the poverty incidence or the head count ratio; P_1 measures depth of poverty (poverty gap) and P_2 measures poverty severity or squared poverty gap. This takes into account not only the distance separating the poor from the poverty line (the poverty gap), but also the inequality among the poor.

4. RESEARCH SETTINGS AND POVERTY PROFILE

In this section we present nature and source of data, describe poverty analysis and socioeconomic characteristics of participants and non-participants.

4.1. Data sources

The paper will employ a longitudinal household data of the Ethiopian Rural Household Survey (ERHS). The survey was conducted in six rounds in 1994^[1] (two times), 1995, 1997, 1999, and 2004 which encompasses 15 peasant associations (PAs) in four regions (Tigray, Amhara, Oromia and South Nations and Nationalities People which consist of more than 85 % of Ethiopian population), covering a sample of approximately 1480 households. The shares within the sample were broadly consistent with the population shares in the three main sedentary farming systems in the country. For these reasons, the sampling frame to select the villages was stratified in the main agro-ecological zones and sub-zones (excluding pastoral and urban areas), with one to three villages selected per strata. Further, sample size in each village was chosen so as to approximate a self-weighting sample (Dercon et al., 2005).

The paper estimates separate treatment effects for participation in FFW and FFD program because the two programs have different eligibility requirements in most villages. Correspondingly, in definition 1: a household is considered a treatment household if it participates in FFW program. A household is a control group when it does not participate in FFW program. In definition 2, a household is considered a treatment household if it obtains FFD distribution, and it is in control group when it does not participate in FFD program.

4.2. Poverty profiles and decomposition

Using the absolute overall poverty line of Br 50 Birr per month per capita about 30 and 27 % of the sample in the villages in 1999 and 2004 respectively lived under the poverty line (Table, 1). The test results also show that there is significant difference in poverty levels before and after intervention. Our calculation shows that poverty is reduced by 11 percent.

Table 1. Aggregate poverty ratios in 1999-2004

Poverty indices	1999 (n= 1208)	2004 (n= 1208)	% Change in poverty measures	Significance test
Indices based on cost of basic needs (adult-equivalent)				
Real consumption (in adult-equivalent)	103	111	7.2	-2.00**
P ₀	0.30	0.27	-11.11	1.55***
P ₁	0.10	0.09	0.1	0.14
P ₂	0.05	0.04	0.4	0.41

Figures marked with *** and ** are significant at the 1% and 5% levels, respectively.

[1] Two times in 1994: first form March to July and a second wave from October 1994 to January 1995.

The results in Table 2 showed that no significant difference in poverty incidence for FFW participant and non-participants before intervention(1999-data) about 30 percent of the individuals in FFW participant and non-participants households have been identified as poor. Whereas after intervention in 2004 about 26 percent of the individuals in participants were identified as poor while about 28 percent of the individuals in non-participants were identified as poor. Even though the head count index show a moderate fall (4%) after program intervention, poverty profile in general indicate that the presence of FFW targeting inefficiency. In other words, some poor households have no access to FFW participation while some of the non-poor households do enjoy access to FFW. For FFD program, poverty incidence of participants and non-participants are statistically significant before intervention-1999. While after intervention not only poverty incidence substantially reduced also the difference in poverty incidence between participants and non- participants is not significant. This confirms that intervention reduces poverty significantly.

Table 2. Decomposing of poverty ratio changes by FFW and FFD programs 1999-2004

Poverty ratio	Participants	Non-participants	Significance test
FFW Participants and non-participants in 1999 adult-equivalent			
Real consumption (in adult-equivalent terms)	92	108	-2.8***
P ₀	0.30	0.30	-0.20
FFW Participants and non-participants in 2004 adult-equivalent			
Real consumption (in adult-equivalent terms)	96	118	-2.99**
P ₀	0.26	0.28	-0.28
FFD participants and non-participants in 1999 adult-equivalent			
Real consumption (in adult-equivalent terms)	85	109	-4.0***
P ₀	0.37	0.27	3.5***
FFD participants and non-participants in 2004 adult-equivalent			
Real consumption (in adult-equivalent terms)	95	116	-2.78***
P ₀	0.26	0.27	-0.29

Figures marked with *** and ** are significant at the 1% and 5% levels, respectively.

The summary statistics presented in Table 3 indicates that the educational level of the households' head statistically differ between the two groups. Average age of the head for participants is smaller than the non-participants, also significant. This is consistent with the proposition that FFW participation requires active and young workers. Similarly, there are significant differences in the area of land holding. Actually, participants have low real consumption in adult-equivalent and livestock holding (tlu) per adult-equivalent so that they use FFW as a coping mechanism during shocks.

Table 3. Characteristics of FFW and FFD participants' and non-participants': summary statistics

Variables	FFW			FFD		
	Partici- pants	Non-par- ticipants	Differ- ence (%)	Partici- pants	Non-par- ticipants	Differ- ence (%)
Number of observations	404	804		310	898	
Average-schooling of the hh head	0.85	1.5	-76%***	1.12	1.37	-22%
Average-household head age	47	50	-6%***	50	49	2%
Average-land area owed(he)	1.4	1.2	14%***	1.1	1.31	-19%**
Average-household size in 2002	5.01	4.73	9%***	4.59	4.90	6.3%
Average-dependency ratio	0.45	0.42	6%	0.43	0.43	0%
Average-number of people that will help in time of need	6.0	5.5	8%	6.6	5.3	19%
Average-number of iddir households belong to before drought	1.2	1.3	-8%	1.2	1.3	8%
Average-livestock holding(tlu) per adult-equivalent	0.89	1.2	-34%***	0.81	1.2	-48%***
Average-real consumption per adult-equivalent	92	108	17%***	85	111	30%***
Categorical variables						
Household head born in the village(yes=1)	56%	73%	-2.03**	72%	71%	-0.3
Household spouse born in the village village(yes=1)	37%	37%	-0.23	40%	36%	1.9**
Household head holds official position village(yes=1)	23%	19%	-1.71	22%	20%	0.47
Parents holds official position village(yes=1)	16%	15%	-0.37	16%	15%	0.69
Relatives hold official position village(yes=1)	43%	38%	1.37	40%	39%	0.46
Household head is important person in the village village(yes=1)	72%	64%	2.66***	63%	68%	1.48
Spouse is important person in the village village(yes=1)	61%	53%	2.44***	50%	58%	-1.93**
Household experienced drought between 2000-2002 village(yes=1)	37%	21%	5.57***	37%	23%	4.59***
Households member died, 2002-2004	7%	11%	-1.97**	10%	9%	0.11
Household had serious illness village(yes=1)	3%	1%	1.86*	1%	1%	0.69
Formal education village(attend=1)	19%	22%	-1.85*	22%	22%	-1.85*
All household members are sick/weak/young/old village(yes=1)	0.2%	5%	-4.12***	5%	0.2%	2.36**

Figures marked with ***, ** and * indicate statistically significant differences at the 1%, 5% and 10% levels, respectively.

Participation in FFW programs is not only a decision made at the household level; local administrators influence the decision as well. Our paper considers possible indicators, such as: household's social network and its political connections to identify the role of connections on participation. Being household head and the spouse of a prominent member with relevant social status in the village might be positively correlated with participation.

On the other hand, FFD participation is negatively correlated with land holding, livestock holding and real consumption. Besides, prevalence of disability, sickness, old age, or other lack of livelihood among household members implies a higher probability of access to participate in this program. This shows that FFD targeting is relatively efficient in identifying the targeted poor households (Table 3).

4.3. Regional decomposition based on targeting efficiency indicators

There are differences in access to productive assets (like human, physical, natural, financial and social) across regions. For example the mean land holding for Tigray, Amhara, Oromia and SNNP are 0.6, 2.2, 2.6 and 1.1 hectares respectively. This may lead to different set up of food aid distribution. We used odds ratio to examine the strength of association between participation and targeting indicators. The FFD program was more efficient than the FFW program was. Poor households were more likely to participate in free food program. For those who were poor, the odds of participating in the program were twice as high as for those who were not poor.

Table 4. Regional decomposition of FFW/ FFD program participation and targeting indicators

Odds Ratio for food-for-work program participation					
Targeting indicators	Total sample	Tigray	Amhara	Oromia	SNNP
Household had experienced drought 2000-2002	2.07	3.55	1.51	1.54	3.83
Poor in 1999	1.10	0.43	1.20	1.05	1.75
One of the household member had official position	1.08	1.55	1	0.88	0.27
Spouse born in the village	0.86	1.15	1.31	0.75	0.27
Spouse is important person in the village	1.88	2.43	1.52	1.81	0.32
Head is important in the village	1.92	3.73	1.59	1.24	0.33
Odds ratio for free-food-distribution					
Household had experienced drought in 2000-2002	1.75	1.10	1.26	1.80	3.46
Poor in 1999	1.99	5.25	2.65	1.50	1.60
One of the household member had official position	0.90	1	0.68	1	1.27
Spouse born in the village	0.89	0.71	1.33	0.59	0.86
Spouse is important person in the village	0.84	0.97	0.61	0.85	1.43
Head is important in the village	0.95	0.87	0.82	0.82	3

Figures are based on odds ratio calculation^[2].

[2] Odds ratio refers to likelihood the event will occur compared likelihood it will not occur. Odds ratio is used to compare the odds of something occurring to two different groups. It is the ratio of the odds for the first group and the odds for the second group. The formula, where p is the probability for the participation on FFW and FFD programmes, and q is the probability for targeting indicators, is $\frac{p/(1-p)}{q/(1-q)}$.

In the Southern Nations, Nationalities and People's (SNNP) region, food-for-work was more efficient in targeting the poor than in the other three regions. Besides, political and social connection did not lead to higher participation in the program. However, in the region of Tigray, there is a clear gap in targeting the eligible households: non-poor participants were around two and half times higher than the poor participants. Similarly, in households with members occupying official positions or where either the head or the spouse belonged to the prominent in the village, higher program participation was observed. This suggests that demand for food-for-work job in the region, typically characterized as poor, drought prone and limited access off-farm activities among the Ethiopian regions, is higher than access to food-for-work job. Hence, the farmers' access to food-for-work is likely to be rationed and the access to food-for-work and the income from food-for-work are administratively determined. Consequently, many of the farmers are not allowed to work as many days as they are willing to work.

In contrast, FFD appears to have been more efficient in terms of targeting the poor in the region of Tigray than it was in the SNNP, Amahar and Oromia regions. The probability of poor participation in this program was five times higher than non poor participants. Similarly, program participation had no strong association with political and social connections indicators in the region perhaps due to the fact that free-food distribution is more or less determined by community participation to select the poorest of the poor as the most appropriate participants. However in Southern Nations, Nationalities and People's (SNNP), FFD program participation had association with political and social connections. For example being the household head with official connections and a spouse of somebody with higher social status in the village, increases the probability of participation in a FFD program by approximately three and half times.

In line with the observation different regions in Ethiopia have different social, economical and political set up, consequently the results confirms that geographically untargeted intervention may induce unintended effect. In other words, the results suggest the need for more integrated and geographically based approach of assets enhancement with appropriate complementarities.

5. ECONOMETRICS RESULTS: IMPACT EVALUATION AND DETERMINANTS OF WELFARE GROWTH

In the previous section, we presented a general view as to what happened to poverty between participants and non-participants. An analysis of impact evaluation will not be complete without performing further econometric analyses which draw on to quantify the impact of intervention on poverty reduction. In particular, we are interested in examining of the causal effect of direct participation.

5.1. Difference-in-differences propensity score matching

Two steps are involved during the application of the propensity score matching methodology. First, we estimate households' propensity scores matching based on their basic and broad set of attributes for both the FFW and FFD programs. Logit models are estimated with a broad set of covariates to estimate the propensity score which used to match participants and non-participants. In the literature, there is limited guidance on how to choose the set of covariates to estimate the propensity scores. However, parameterizing propensity score matching specification has the advantage of finding matches as close as possible (Gilligan and Hoddinott, 2007). Moreover, the explanatory variables included in the Logit model should be closely related to the outcome variable and participation in the program, but they should not be affected by the program intervention (Barraud, 2009). Therefore, the explanatory variables in the Logit model are selected based on theoretical grounds, data set and other conditions stated above.

The advantage of having longitudinal data (panel) is to compare groups using before and after intervention. Thus, the paper incorporates the difference-in-differences matching estimation approach. For measuring the poverty reduction impact of food aid, the paper takes the logarithm of the ratio of consumption in adult-equivalent (divided by poverty the line) of 2004 to 1999 for both the participants and non-participants^[3]. Welfare growth (poverty reduction) in participants and non-participants is represented as:

$$Y^1 = \ln \left[\frac{Rconsae^1_{2004}/Z}{Rconsae^1_{1999}/Z} \right] \quad Y^0 = \ln \left[\frac{Rconsaeu^0_{2004}/Z}{Rconsaeu^0_{1999}/Z} \right] \quad (15)$$

Where, Y^1 and Y^0 stand for welfare growth of participants and non-participants, $Rconsae1$ and $Rconsae0$ are real consumption in adult-equivalent for participants and non-participants and Z is the poverty line. Growth rate as a household welfare measure may yield a greater than one or a less than one, implying an improvement or deterioration of the welfare of the household.

The second step implies subtracting off the difference in pre program welfare growth between the food aid recipient and the matched comparison group of recipients using Kernel matching and nearest neighbor comparisons. Then we estimate the average treatment of the treated (ATT), the wellbeing difference between the participant and the non participant (Lee, 2006).

[3] We also indicated wellbeing as a binary variable for poor or non poor. We used the change in the number of the poor between 1999 and 2004 for both participants and non participants. However, the results were not as strong as the results from the survey regression model we reported here.

To construct the propensity score of the FFW program, we use a broad set of covariates, such as: the logarithm of lagged real consumption in adult-equivalent for previous rounds, household characteristics (household size in 2002, the logarithm of household age, female as household head, the formal education of the household head and farmer as being the primary job of the head); asset holding (Land in adult-equivalent, land size squared and livestock holding); and social and political connection of households (Logarithm of the number of people helped in times of need, household head having an official position, household head born in the village, spouse born in the village, head is an important person in the village, spouse is an important person in the village, one of the parents hold official position, household participation in at least one iddir^[4], network size has declined in last five years, network has grown in the last five years) and different shocks (household experienced drought between 2000 & 2002, household member had serious illness between 2000 & 2002, and one of the household members died between 2000 & 2002).

Similarly, many of the same covariates are used to construct the propensity score of the FFD program. Providing FFW and FFD have different eligibility criteria, some variables having high correlation with FFD program participation, such as: schooling (the highest grade of the household head), if all household member are weak, sick, old or young, households with no livestock and one of household members is sick between 2000-2002 and female headed with no land are added.

Considering the conditional independence assumptions, we investigated different alternative specifications including different covariates affecting the welfare growth (poverty reduction) variable like lag of livestock holding and land holding, but the result did not statistically change. Similarly we made different types of balancing tests^[5] with satisfactory results.

Results of the Logit formulation of the propensity score for both FFW and FFD programs are reported in Table 5. The probability of FFW participation is declining with the difference in log of real consumption 1997-1999. This may support the FFW participants which are more likely to have less real consumption than non-participants. As has been noted in the descriptive analysis, the propensity score matching estimation depicts participation decrease with age. This may be validating one of the FFW criteria which allow younger and active worker to participate. Besides, the older people may have higher opportunity cost to participate in FFW programs. Further on, FFW participation declines with Livestock holding.

[4] Mutual aid association, sharecropping and calling work party/labour sharing, is usually formed among persons united in family and friendship, by place of work, by living in the same localities

[5] such as a test for standardized differences, a test for equality of means before and after matching and common support graph

Table 5. Estimation of the propensity score^[6] for participation in FFW and FFD

Logit specification	FFW	FFD
Difference in ln-real consumption in adult-equivalent , 1997-1999	-0.13***(3.53)	0.03(0.78)
Difference in ln-real consumption in adult-equivalent , 1995-1997	-0.09**(2.09)	0.10(2.12)
Difference in ln-real consumption in adult-equivalent , 1994-1995	-0.11**(2.67)	-0.03(0.74)
Ln-household size in 2002	0.28**(1.99)	-0.32***(2.19)
Land in adult-equivalent(ha)	0.41(1.5)	-1.73***(3.63)
Land square	0.05***(2.57)	0.05***(2.35)
Ln-age of head	-0.85***(3.59)	0.51** (1.94)
Household head is female	0.05(0.22)	-0.43*(1.78)
Primary job of head is farmer	0.27(1.26)	-0.79***(3.48)
Head Schooling(years)		-0.05** (1.73)
Weak/old/young households		1.75** (2.38)
Households with no livestock & one of household member is sick 2000-2002		2.48***(2.73)
Female headed with no land		0.09(0.17)
Formal education of head	-0.44**(2.52)	
Tlu in adult-equivalent	-0.42***(4.32)	-0.32***(2.92)
Ln of number of people that help in time of need	-0.03(0.35)	-0.29***(2.94)
Households experienced drought between 2000 & 2002	0.76***(4.76)	0.78***(4.39)
Household member had serious illness between 2000 & 2002	1.80*** (3.52)	0.37(0.66)
One of the household member dead between 2000 & 2002	0.74***(2.59)	-0.39(1.13)
Household head had official position	-0.12(0.60)	0.60***(2.73)
Household head born in the village	-0.19(1.11)	0.23(1.25)
Spouse born in the village	-0.15(0.97)	-0.10(0.60)
Head is important person in the village	0.57***(2.6)	0.45** (1.95)
Spouse is important person in the village	0.31(1.57)	-0.222(1.05)
One of the parents hold official position	0.18(1.11)	-0.06(0.32)
Network size has declined in last five years	-0.135(0.84)	-0.56** (2.16)
Network has grown in the last five years	-0.601**(3.25)	-0.39** (2.2)
	LR chi2(29) = 250.55 Prob > chi2 = 0.00 Pseudo R2 = 0.197 Predicted prob. = 0.51	LR chi2(32) = 201.02 Prob > chi2 = 0.00 Pseudo R2 = 0.179 Predicted prob. = 0.51

Figures marked with ***, ** and * indicate statistically significant differences at the 1%, 5% and 10 % levels, respectively. Absolute value of z-statistics in the parenthesis.

[6] We performed different types of tests such as heteroskedasticity, and other possible misspecifications (e.g. non-normality and multicollinearity) and the results are satisfactory

Not surprisingly, there is a positive correlation between participation in the program and various idiosyncratic shocks like illness or death of one of the household members and drought. The fact that socio-political connection of the household, such as: being the household head and spouse is important in the village has a positive relation with participation. This may be attributed to targeting inefficiency of FFW program. This support the evidence of preferential treatment in favor of the group that have an important social position in the village allowing some groups to participate in the program especially when FFW participation is scarce.

For the FFD program, the estimated propensity score matching in contrast to the FFW, participation increase with age of the household head. Similarly, households with disabled, elderly or sick members have a strong tendency to participate in FFD program. These indicate that the FFD program is effective in achieving the target of reaching the disabled and sick people. Households with large family size, higher livestock and land holding are less likely to participate in FFD programs.

Similarly, the interaction variables, such as: the households being female headed with no land and households with no livestock & one of household member were sick have strong and positive association with participation in FFD program. These indicate that the FFD program is relatively effective in including targeted group. On the other hand, the social and political connection like household head had official position and head is important person in the village of households has a positive correlation with FFD program participation. This may contrast to targeting efficiency which points out towards an error of inclusion in the FFD program participation.

5.2. Average impact of participation in FFW/FFD programs

The problem with such mean separation tests and poverty decomposition is the non-comparability of the two sub-samples and also the fact that we did not control for the effect of other covariates. Hence, we will systematically analyze if participation has led to significant effects on poverty using difference-in-difference matching estimates and switching regression.

The matching estimates where the treated and control households were matched on the basis of their scores kernel methods show there is a significant effect on household poverty because of participation. The results presented in table 6 indicate participation in FFW and FFD programs, reduce poverty. FFW Treatment has reduced poverty by 8.4 % on average. Similarly, for the case of the FFD program, the treatment effect has reduced poverty by 8.2%.

Table 6. Difference-in-difference estimates of the impact of FFW/FFD programs

Welfare growth	
Mean Impact	
Average outcome, FFW participants	0.125
Average outcome, non-participants	0.041
Difference in average welfare growth, ATT	0.084 (2.12)**
Average outcome, FFD participants	0.151
Average outcome, non-participants	0.069
Difference in average welfare growth, ATT	0.082 (1.92)*

Note: absolute value of t-statistics in parenthesis.

Bootstrapped standard errors using 1000 replications of the sample.

Figures marked with ** and * are significant at the 5% and 10% level, respectively.

5.3. Switching model results: determinants of welfare growth

To assess the robustness of our results, we also used endogenous switching regression to analyse the impact of FFW and FFD programs on welfare growth. To analyze the correlates of welfare growth we include a broad set of explanatory variables. Poverty status and changing economic environment are closely related with initial condition and endowment, the model includes a broad set of covariates from the base year (1999), such as: the lagged household and demographic characteristics, and asset holdings; the change in these variables (like the changes in the household size from 1999 - 2004). It also includes some variables from the 2004 data set like access to assets (financial, public service, market and others) (Hagos, 2005).

The regression model shows that the selection and unobserved heterogeneities bias term is significant and some coefficients are different statistically in each regimes (participants and non-participants) (see Table, 1A in the appendix) for both equations, which suggests that splitting and considering the endogeneity problem is important in getting consistent coefficients. The likelihood test ratio, for both the FFW and FFD program participation, depicts a significance selection bias adjustment and other variable specifications are also significant.

In the interest of brevity, we discuss selected variables which have statistically significant effect on welfare growth for both FFW participants and non-participants. Lagged consumption has positive and significant impact on welfare growth. This supports the hypothesis that the initial condition matters. There is positive correlation with welfare growth and access to market and to improved road which is consistent with the finding of Dercon, et al, (2008).

Likewise, household size and the change in the household size are negatively correlated with welfare growth. Wealth regressors like land and livestock are not significant. But the coefficient on the change in size of land and livestock are found to be positive and significant. The change in the household head age has a negative and significant association with welfare growth for FFW participants and a positive one for non-participants. The negative association of being the household head, farmer is the primarily job of the head and welfare growth may

indicate that households primarily dependent on farm activities are less likely to escape from poverty. The household head highest grade is negatively correlated with FFW participation but it is positively correlated with welfare growth.

In the FFD program, similar to the FFW, we observe that the lagged real consumption has positive and significance relation with welfare growth. Households visited by an extension agent at least once in the main season have significant and positive correlation with escaping from poverty. This may reflect access of the household to better information farm technologies. Access to market has positive correlation with welfare growth for both FFD participants and non-participants. This may be explained as households which have better access to market information, better off-farm activities, and lower costs of input, reduce the impact of shocks and permit to diversify their income.

However, shocks like drought and death of one of the household members; family size; and household heads only participating on farming have significant negative association with welfare growth or poverty reduction. These closely show that shocks have still substantial effect on the livelihood of rural households.

5.4. Switching model results: impact of FFW and FFD program intervention

The predicted welfare growth from the endogenous switching regression model is then used to examine the mean welfare growth gap between participants and had they not been participated. The result from the regression indicates that the mean value of welfare growth of FFW participants is statistically higher than had they not been participating. This is consistent with the result from the Kernel propensity score matching. Considering FFW program in (Table 7), it clearly shows that FFW participants mean welfare growth is 8 % higher, but in case they had not participated in the program the mean welfare growth might decrease by 24 %.

For FFD program, Table 7 reports that the mean value of the welfare growth difference between FFD participants and had they not participated is positive and statistically significant. It shows a 17 % welfare growth of participants. However, had they not participated in the FFD program, the predicted mean welfare growth might decrease by 26 %, which is in similar to the results from the Kernel propensity score matching.

Table 7. Summary of predicted values for welfare growth FFW and FFD participants

Type of users	Predicted mean welfare growth participated	Predicted mean welfare growth had they not participated	Predicted welfare growth difference
FFW Program	0.086	-0.235	0.34(.048)***
FFW St.dev	0.667	0.692	
FFD Program	0.165	-0.256	0.42(0.041)***
FFD St.dev	0.737	0.716	

Values in parenthesis are p-values.

Bootstrapped standard errors using 1000 replications of the sample.

Figures marked with *** are significant at the 10% level.

6. CONCLUSION

Consistent results from descriptive, difference-in-differences matching and switching regression analysis show that food aid has a positive effect on poverty reduction by mitigating the impact of shocks and relaxing the liquidity constraint. Nonetheless, such public interventions, linking FFW to investment in education, roads, markets, irrigation and small scale enterprises should be emphasized as a way of helping people to escape from the poverty trap. This could enhance domestic production in the long run, thereby minimizing the food gap, which currently is filled with food aid.

The results from the poverty profile, regional decomposition based on targeting indicators and regressions confirm that the existence of targeting errors from both excluded and included participants. The percentages of poor and non poor participants in the programs are not statistically differing and the socio-political connection of the household seems to influence household participation. Besides, there is also difference in targeting the eligible households across regions. Hence, there is still room for improvement in the distribution of food aid through targeting the poorest and at the same time a need to move from geographically untargeted intervention to a more integrated and geographically based approach of asset enhancement with the implementation of complementary policies.

The switching regression result of the analysis concentrates on the main determinants of welfare growth. Households in Ethiopia have limited access to modern farm technology either because of financial constraints or limited information. The results also show that updating the households with farm technology information, together with disseminating simple and domestically invented technology, seems to reduce poverty remarkably. Moreover, access to market, improved road, initial welfare condition, extension service, and education have significant positive effects on poverty. These calls for a public and public-private partnership intervention to foster market development, increase investments in roads and education, and improve extension services, in order to help program participants to escape from poverty and, ultimately, from dependence on food aid.

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ANNEX I: DETERMINANTS OF WELFARE GROWTH: SWITCHING MODEL FOR FFW AND FFD PARTICIPANTS AND NON-PARTICIPANTS

Variables	Participants FFW	Non-participants FFW	Participants FFD	Non-participants FFD
Difference in ln real consumption (in adult-equivalent terms), 1997-1999	0.13***(5.18)	0.19***(11.45)	0.13***(4.51)	0.13***(7.91)
Difference in ln real consumption (in adult-equivalent terms), 1995-1997	0.04 (1.58)	0.019(0.90)	-0.05(1.52)	-0.01(0.11)
Difference in ln real consumption (in adult-equivalent terms), 1994-1995	0.02 (0.81)	0.037(1.98)	0.01(0.28)	0.01(0.14)
Land in adult-equivalent	-1.13*** (4.99)	-0.12(0.88)	-0.93(1.6)	0.11(0.63)
Land area owned squared	0.03(0.11)	-0.02(1.61)	0.01(0.29)	-0.01(0.59)
Lives stock holding in adult-equivalent	-0.11(1.38)	-0.12***(3.25)	-0.30*(1.8)	0.12(1.15)
Household size	-0.14*(1.70)	-0.16***(2.54)	0.03(0.16)	-0.19*(1.81)
Household size square	0.01(0.89)	0.01*** (2.31)	-0.01(0.38)	0.01(1.14)
Household head Age	0.01(0.44)	0.01(0.57)	-0.02 (0.95)	-0.02(1.25)
Household head Age square	0.01(1.13)	0.01 (0.64)	0.74(0.72)	0.469(0.85)
Household head has any formal education	0.64** (2.90)	0.39** (2.74)	0.03(0.81)	0.04 (0.55)
Dependency ratio	-0.01(0.03)	0.07(0.82)	0.29(1.00)	0.14(0.82)
Households use fertilizer in one of their plot	0.08(0.54)	0.20** (2.64)	0.12(0.80)	0.34*** (4.3)
Households practice soil and water conservation	0.07(0.66)	0.12*(1.86)	0.07(0.56)	0.23*** (3.16)
Households practice water harvesting	0.17(1.17)	-0.05(0.60)	0.42*** (3.31)	0.06 (0.70)
Households experienced drought between 2000-2005	-0.34** (2.38)	-0.01(0.11)	-0.07(1.35)	-0.16(1.95)
Household member had serious illness 2000-2005	0.18(1.19)	0.03 (0.32)	0.17(0.82)	0.16(1.47)
Households visited at least once by extension agent	-0.08(0.80)	0.12 (1.51)	0.29** (2.08)	0.21*** (2.61)
Villages that have no market	-0.76** (2.53)	-0.50*** (4.45)	-0.62** (2.86)	0.42*** (4.61)
Access to electricity	0.472(1.23)	-0.38*** (2.32)	0.34(0.39)	0.034(0.26)
Accesses to road improve	0.67*** (3.85)	0.24** (2.59)	0.87*** (4.34)	0.13*(1.42)
Households have access to loan	0.13(1.29)	-0.091(1.30)	0.21*(1.78)	0.03(0.42)
Households has access to equip	-0.01(0.07)	-0.039(0.38)	-0.06(0.32)	-0.03(0.30)
The household head primary job is farmer	-0.20*(1.54)	-0.20** (2.0)	0.07(0.63)	-0.09(1.17)
Household member died, 2000-2005	0.32*** (3.23)	-0.14*(2.06)	0.21* (4.56)	-0.04 (0.57)
Change livestock holding(1999-2004)	0.02** (2.43)	0.01** (2.08)	0.03** (2.31)	0.01*** (2.96)
Change land holding (1999-2004)	0.115(3.45)	0.08*** (2.44)	0.08*(1.88)	0.06** (2.13)
Change household head age(1999-2004)	-0.01*(1.87)	0.01** (2.73)	-0.01(0.82)	0.01** (2.06)
Change household size (1999-2004)	-0.14*** (5.65)	-0.17** (10.34)	-0.13*** (3.2)	-0.12*** (4.43)
Constant	1.03(1.58)	-1.15** (2.83)	-2.49(0.88)	-2.47(1.16)
Household head is female	-0.34*** (2.57)	-0.03(0.12)		
Schooling	0.15*** (3,26)	0.07*** (3.74)		
Poor in tlu			0.02 (0.74)	-0.015(1.54)
Households are poorest in land holding			0.30*(1.84)	-0.22** (2.08)

Note: absolute value of z-statistics in parenthesis.

Figures marked with ***, ** and * are significant at the 1%, 5% and 10 % levels, respectively.



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