What is the Optimal Locus of Control for Social Assistance Programs?: Evidence from Ethiopia

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Centralized implementation mandates of Ethiopia's Productive Safety Net Program require a full and uniform payment to each person in an eligible household. In practice, however, communities do not receive enough funding to fully implement the program. Therefore, communities must exercise local discretion in allocating aid. We extend the methodology of local equivalence scales to recover the preferences revealed by local communities' aid allocations and find they are pro-poor, allocating more to underprivileged groups with lower wage earnings potential (e.g., teenage girls vs. teenage boys, adult women vs. adult men, elderly vs. working age adults). Despite communities' pro-poor implementation, the program with constrained funding does not significantly lower overall poverty rates. In simulations with full funding, the program reduces poverty in both cases of centralized and decentralized program control, with different allocation criteria. The major policy takeaway is that the financial scale of the safety net program is more important to poverty reduction than the locus of control over implementation.

*Charles H. Dyson School of Applied Economics and Management, Cornell University, Ithaca, NY 14853 (e-mail: ams727@cornell.edu) *Acknowledgments:* I am indebted to Alemayehu Seyoum Taffesse, Bart Minten and the team at the Ethiopian Strategy Support Program for many useful discussions and logistical support during my time in Ethiopia. I am grateful to the staff of Ethiopia's Central Statistical Agency (CSA) who conducted the household surveys, and to CSA's Director General, Samia Zekaria, for sharing the data. Further, I have benefited from useful discussions with Harold Alderman, Chris Barrett, Garrick Blalock, Kalle Hirvonen, Matt Hobson, John Hoddinott, Lena Kuhn, Shanjun Li, Paul Novosad and numerous seminar and conference participants. I gratefully acknowledge support from the National Science Foundation through Cornell University's Food Systems and Poverty Reduction Integrative Graduate Education and Research Traineeship program. All views expressed are my own. *Keywords:* social

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1. Introduction

The debate over the optimal locus of government program control dates at least to Oates (1972) who argued that the main rationale for decentralization is bringing decision-makers closer to the people, thereby increasing the chances that leaders' choices reflect the preferences of the people. Since Oates, a broad and robust literature—theoretical and empirical—debates whether a centralized or decentralized approach is more appropriate for the delivery of social assistance programs.[1] Further, when focusing on implementation of social assistance programs in developing countries, a significant body of research argues that decentralization makes things worse for the poor. For example, decentralized education spending in Uganda was unintentionally regressive (Reinikka and Svensson 2004); local governments selected local work projects with less employment of the poor in West Bengal (Bardhan and Mookherjee 2006); and test scores in poor municipalities did not change despite improvements to test scores in wealthier municipalities from schools decentralization in Argentina (Galiani, Gertler, and Schargrodsky 2008).

In this paper we examine winners and losers from the unintended decentralized implementation of Ethiopia's Productive Safety Net Program (PSNP). The central government dictates a precise allocation rule, with full and uniform transfers per person

[1] Arguments favoring decentralized implementation include lower costs to acquire detailed and accurate information (Alderman 2002), increased responsiveness to local needs (Faguet 2004), increased knowledge of what is politically and socially feasible in the local context (Pritchett 2005), increased accountability (Agrawal and Ribot 1999), less corruption (Fisman and Gatti 2002), and encouragement of local participation (Véron et al. 2006). However, others argue that decentralization worsens service delivery, for example when there is political capture by local elites (Bardhan and Mookherjee 2000; Bardhan and Mookherjee 2005), when preferences of local decision makers are not pro-poor (Conning and Kevane 2002), when local governments have weak implementation capacity (Smith 1985), when monitoring mechanisms such as free press are weak (Lessmann and Markwardt 2010), or in ethnically heterogeneous or sparsely populated areas (Olken 2006).

for participating households. In practice, however, communities do not receive enough funding to implement the program according to the central government mandate. Therefore, communities must use local discretion to distribute aid. In order to examine the distributional impacts of this decentralized approach, we need a rule to compare the welfare of households of differing sizes and compositions; however, this rule must be flexible enough to allow for community specific criteria to influence both which households are selected into the program and how much aid they receive. The literature does not provide an adequate rule, so we derive one theoretically based on the principle of revealed preference and develop an empirical method to implement it building on Olken (2005). We then use the estimated allocation rule to examine the distributional consequences of decentralized implementation.

We find that decentralization can lead to more pro-poor allocation rules, and that Ethiopian communities allocate more aid to underprivileged groups with lower wage earnings potential (e.g., teenage girls vs. teenage boys, adult women vs. adult men, elderly vs. working age adults). However, when comparing the communities' pro-poor approach with the central government's uniform allocation rule—in which the same reduced budget gets spread evenly among fewer beneficiaries, each of whom receives the full prescribed payment—we find that overall poverty rates do not vary significantly between the two approaches. By contrast, when we simulate poverty levels with a fully funded program, we find that both the decentralized approach and the centralized approach reduce overall poverty rates by approximately the same amount.

The contribution of this paper is twofold. The first is methodological. We extend Olken's (2005) technique of estimating locally determined equivalence scales to settings where communities determine not only the extensive margin (i.e., whether a household receives aid or not) but also the intensive margin (i.e., how much aid each beneficiary household receives). This adds to the thin literature on "socially adequate" consumption levels as described by Pollak and Wales (1979). They argue that equivalence scales based on demand systems aptly deal with the creation of cost of living indexes where it is appropriate for the social scientist to specify the base preference ordering against which

all households are measured. They also argue, however, that traditional demand based techniques of calculating equivalence scales do not deal adequately with the broader question of what communities or societies feel is the "socially adequate" consumption level. This paper presents a method to arrive at "socially adequate" consumption levels.

The second is a policy contribution. The overall program funding level matters far more for poverty reduction outcomes than does the locus of program control. The overall takeaway in regards to the optimal locus of program control—that resultant poverty levels are statistically indistinguishable between the decentralized and centralized approach—is similar to Alatas et al. (2012). They find that while centralized targeting efforts (proxy means tests) perform slightly better than community-based targeting in identifying those below Indonesia's poverty line, the difference between these two methods does not yield statistically significantly different effects on reducing overall poverty rates. In sum, the overall funding level drives performance in reducing poverty more than the locus of program control.

2. Background and targeting of the Productive Safety Net Program

More than 80% of Ethiopia's population lives in rural areas and relies on rain-fed agriculture as its main livelihood. Historically, insufficient and variable rainfall caused cycles of food shortage and famine, and the government of Ethiopia requested international assistance when needed. In the early 2000s, the government and a consortium of international donors moved towards a model to address underlying chronic food insecurity instead of repeated *ad hoc* emergency appeals for acute food shortages caused by drought. Therefore, the government of Ethiopia launched the Productive Safety Net Program in January 2005.

The PSNP is designed to assist approximately 7-8 million people per year and has an approximate annual budget of USD$350 million (Development Assistance Group 2010). The PSNP has two major parts: 1) a large public works (PW) program in which food insecure households provide daily labor to public works projects in exchange for food or

cash,[2] and 2) a smaller direct support (DS) component in which households without available labor (generally the elderly or disabled) receive a transfer with no work requirement.

2.1 Targeting of program participants

A combined administrative and community targeting approach is used in the PSNP. The amount of aid allocated to each district is determined at the federal level (based on need and historic receipt of food aid). Once district aid levels are determined, the districts work with all of the villages within that district to determine exact beneficiary lists.[3] The Program Implementation Manual (PIM) mentions key criteria for participant selection including: household is a member of the community, household has faced continuous food shortages, and household has faced sudden serious shock, and/or household lacks adequate family support or other means of social protection. These criteria are broad and allow for significant local level discretion in determining who participates and who does not (as documented by Caeyers and Dercon (2012) in a similar Ethiopian program).

The exact administrative process for determining which households are included in the PSNP beneficiary list is an iterative process between the district and villages. The village level committees, their composition, and responsibilities are as follows:

(i) The Village Council is the elected leadership of the village and is tasked with approving the beneficiary list that is passed to the district and ensuring that the PSNP client list, along with program plans and budgets, are posted in a public place.

[2] One of the government of Ethiopia's initial stated goals of the PSNP was to move away from food aid and towards cash payments as aid. However, some donors, particularly the United States, would only give their contribution to the PSNP in the form of food aid, so the areas supported by US government resources are generally chosen to be the most remote and those with the least market access where food aid is perhaps a better option than cash transfers.

[3] In Ethiopia, a district is known as a *woreda* (20,000-250,000 population), and a village is known as a *kebele* (2,000-4,000 population). The village is the lowest administrative unit of the government. We use the English names in this paper.

(ii) The Village Food Security Task Force (VFSTF) is comprised of village administrators, agriculture extension workers, health extension workers, volunteer community health workers, teachers, and community members. The VFSTF determines which households are eligible for the public works program versus the direct support program.

(iii) The Community Food Security Task Force (CFSTF) is comprised of one representative of the VFSTF, one agriculture extension worker, one health extension worker or volunteer community health worker, 2-3 elected female representatives, 2-3 elected male representatives, and one elected youth representative. Depending on the size of the village, there may be one or more CFSTFs created per village. They mobilize the community for the actual participatory planning exercise to determine households with the highest need. They also organize a public meeting to discuss the proposed list of PSNP participants and give community members the opportunity to suggest the addition or removal of names.

The District Food Security Task Force (DFSTF) approves the plans it receives from the village councils, and if there is some disagreement it gives additional guidance and direction to the village council and other committees. While the program's design allows local discretion to determine which households are in or out of the PSNP (the extensive margin), the instructions are explicit that a uniform payment per household member is required conditional on PSNP participation (the intensive margin). However, the data on actual payment levels shows large deviations from the prescribed uniform payment levels. In fact, contrary to design, between 60-80% of the variation in individual level payments is associated with the lowest administrative level of government (the village). See Appendix A for a full description of the variance decomposition exercise that shows this.

3. Estimating communities' revealed preferences based on aid allocations

Typically equivalence scales are used to compare welfare across households of differing sizes and compositions. Historically this is accomplished by assigning some aspect of a

household's demand decisions to be indicative of the household's welfare. For example, the food share of expenditures (Engel 1895) or the total expenditures on adult goods (Rothbarth 1943). Then the social scientist infers the amount of additional expenditures required to compensate a household with a different demographic composition so that it has the same welfare as a reference household (Deaton 1997; Lewbel and Pendakur 2008). The drawback of traditional consumption based equivalence scales is the strong *a priori* assumption that the social scientist has selected the indicator(s) that correctly proxy for household welfare. For example, the Engel method has been shown to overstate the cost of children (Nicholson 1976), and the Rothbarth method understates the cost of children (Barten 1964). To deal with these biases, the literature developed more and more complex demand systems to account for the substitution effects between adult and children goods (e.g., Deaton & Muellbauer 1986; Lewbel 1997; Browning et al. 2013).

Pollak and Wales (1979) describe a meaningful disagreement within the broader economics field in how comparisons of consumption needs are calculated. They lament that researchers have not been able to develop a method to recover "socially adequate" consumption levels in the typical demand system approaches because the researcher assigns which aspect of household demand is indicative of actual welfare. Olken (2005) proposes an innovative alternative to traditional demand-based equivalence scales based on the revealed preferences of how communities actually allocate aid. This approach would satisfy Pollak and Wales' critique, in that it removes the discretion of the social scientist in deciding what aspect of household demand is most indicative of welfare as it simply observes how communities make the inter-household comparisons for themselves.

Olken's technique is powerful, but it only examines decisions made at the extensive margin (whether or not the household is included in the aid program) rather than also the intensive margin (how much aid the household receives once included in the program). We extend his method and include the intensive margin in estimating the community's revealed preferences concerning the receipt of aid. In doing so, we add to the thin literature on methods for defining a "socially adequate" consumption level.

3.1 Estimating revealed community equivalence scales

Conceptually Olken's model is as follows. Each household's indirect utility function, as evaluated by the community is:

$$v(y,n,k,x,p,a) \tag{1}$$

where y represents total household expenditures (not including aid receipts), n represents total number of people in the household, k represents the number of children in the household, x represents other household characteristics, p represents a vector of prices, and a represents the amount of aid received by the household. Assume v is concave in y and the community maximizes a social welfare function:

$$\max \sum_{i=1}^{I} \beta(y_i,n_i,k_i,x_i,p)v(y_i,n_i,k_i,x_i,p,a_i) \qquad \text{s.t.} \sum_{i=1}^{I} a_i = A \tag{2}$$

where β represents welfare weights on each household, I is the total number of households in the community, and A represents total amount of aid to be distributed. There are important distinctions between β and v. For example, many aspects of a household's welfare might affect the community's decisions such as vulnerability to shocks or increased medical expenditures for the sick. These are captured in v. However, it is possible that other factors besides pure welfare maximization affect a village's decision of how to allocate aid, for example, the political connectedness of a household or a desire to provide social insurance to those suffering a recent unexpected shock. These are captured by β. Because the weights of β may also be related to household composition (through n or k) we cannot separately identify the community welfare weights β and the indirect utility function v in this context (Olken 2005). We can, however, identify the product of the two (called the overall community benefit function), which is denoted:

$$B(y_i,n_i,k_i,x_i,p,a_i) = \beta(y_i,n_i,k_i,x_i,p)v(y_i,n_i,k_i,x_i,p,a_i) \tag{3}$$

Then the community maximization problem becomes:

$$\max_{a_i} \sum_{i=1}^{I} B(y_i, n_i, k_i, x_i, p, a_i) \qquad \text{s.t.} \sum_{i=1}^{I} a_i = A \tag{4}$$

To differentiate the cost of children relative to adults and introduce household economies of scale, we parameterize these effects following Deaton (1997) and Olken (2005). For a given set of prices, let α be the cost of children relative to adults, so that each child costs as much as α adults. Define total number of effective adults to be $(n-(1-\alpha)k)^{\theta}$, where θ captures household economies of scale. As θ increases from 0, economies of scale within the household decline, constant returns to scale in household size corresponds to $\theta = 1$ (the federal uniform benefit schedule of the PSNP corresponds to $\alpha = 1$ and $\theta = 1$). Rewrite B so that it depends on household composition only through the effect of household composition on household expenditure per effective adult (Olken 2005). Expenditure per equivalent adult is defined as:

$$\tilde{y} = \frac{y}{(n-(1-\alpha)k)^{\theta}} \tag{5}$$

and then rewrite B so that it depends on n and k, only through $\tilde{y}$:

$$B(\tilde{y}, x_i, a_i) \tag{6}$$

Following Olken (2005) assume that prices in a local context are constant and remove the price vector p from the community benefit function.[4] Assume B is quasi-concave in income per equivalent adult $\tilde{y}$. Additionally assume that aid's only effect on welfare is through its value as an income supplement. Therefore it follows that:

[4] This assumption means that communities assume that all households within the community face the same prices at a given time.

$$\frac{\partial^2 B}{\partial \tilde{y} \partial a_i} < 0 \tag{7}$$

meaning that conditional on all other household characteristics x, the marginal utility of aid is higher for households with lower effective consumption (i.e., the marginal utility of aid is higher for the poor).

Based on the community benefit function and the assumptions presented, conditional on household characteristics x, the households with the lowest consumption per equivalent adult will receive aid. In theory, this means there is a threshold where all the households above the threshold do not receive aid and all the households below the threshold do receive aid. This threshold will vary by community based on how much aid the community has to distribute, the distribution of household utilities in the community, and the community's preference for targeting aid among the very poor, captured by the magnitude of $(\partial^2 B / \partial \tilde{y} \partial a_i)$.

Next introduce an error term, and the probability that a household receives aid is equal to the probability that a household's consumption per effective adult, as evaluated by the community equivalence scales, is lower than some threshold. This threshold varies by community, so it can be modeled as a binary choice model with community fixed effects. This is equivalent to an equation in the form:

$$\Pr(Receive\_aid_{ij}) = F\left[\gamma_j + \gamma_2 B\left(\frac{y_{ij}}{(n_{ij} - (1-\alpha)k_{ij})^{\theta}}, x_{ij}\right)\right] \tag{8}$$

Where γ_j is the community fixed effect that captures different thresholds in each community and F is the distribution function for the error term.

3.2 Empirical specification of revealed community equivalence scales

Empirical estimation of the community benefit function (8) requires a functional form for B and the distribution of the error term F. Following Olken we use the log indirect utility function. Therefore the probability a household i in community j receives aid is:

$$\Pr(Receive\_aid_{ij}) = F\left[\gamma_j + \gamma_2 \log(y_{ij}) - \gamma_2\theta \log(n_{ij} - (1-\alpha)k_{ij}) + \gamma_3 x_{ij}\right] \quad (9)$$

Because this is nonlinear, we estimate a linear approximation:[5]

$$\Pr(Receive\_aid_{ij}) = F\left[\gamma_j + \gamma_2 \log(y_{ij}) - \gamma_2\theta \log(n_{ij}) + \gamma_2\theta(1-\alpha)\left(\frac{k_{ij}}{n_{ij}}\right) + \gamma_3 x_{ij}\right] \quad (10)$$

This can be extended to include different child age or gender categories to separately estimate equivalence scales for different groupings of children or to examine if communities exhibit a sex bias when distributing aid. To do that, include the percentage of household members in each child age or gender grouping rather than just the overall percentage of children.

Following Olken, we assume that the error term takes the logistic form, which allows us to use the conditional fixed-effects logit model. Rewriting equation (10) to incorporate this functional form requires additional notation. Let r_{ij} be a binary dependent variable equal to 1 if household i in village j received PSNP aid, and 0 otherwise. Let N_j be the number of households in village j and T_j be the number of households in village j that received PSNP aid. Denote d_{ij} to be a dummy variable equal to 1 if household i in village j received PSNP aid or 0 if the household did not receive aid, and denote by S_j the set of all possible vectors $d_j = \{d_{1j}, \ldots, d_{Nj}\}$ such that $\sum_{i=1}^{N_j} d_{ij} = T_j$. Define $\lambda_1 \equiv \gamma_2$,

[5] This is similar to the Working-Leser (Working 1943; Leser 1963) functional form used by Deaton and Muellbauer (1986).

$\lambda_2 \equiv -\gamma_2\theta$, $\lambda_3 \equiv \gamma_2\theta(1-\alpha)$, and $\lambda_4 \equiv \gamma_3$. Substituting the logistic CDF for F in equation (10) and conditioning out the fixed effects yields an empirical specification of the form:

$$\Pr\left(r_{ij}=1 \mid \sum_{i=1}^{N_j} y_{ij}=T_j\right)=\frac{\exp\left[\sum_{i=1}^{N_j} y_{ij}\left(\lambda_1\log(y_{ij})+\lambda_2\log(n_{ij})+\lambda_3\left(\frac{k_{ij}}{n_{ij}}\right)+\lambda_4 x_{ij}\right)\right]}{\sum_{d_j\in S_j}\exp\left[\sum_{i=1}^{N_j} d_{ij}\left(\lambda_1\log(y_{ij})+\lambda_2\log(n_{ij})+\lambda_3\left(\frac{k_{ij}}{n_{ij}}\right)+\lambda_4 x_{ij}\right)\right]} \quad (11)$$

Equation (11) is estimated with maximum likelihood. Then using the estimated coefficients λ_1, λ_2, and λ_3 we recover estimates of θ and α. To compute the revealed community equivalence scale, which is the ratio of the income of the household with a given composition to that of a reference household, set the welfare levels for the reference and comparison household equal, and solve. As per Olken (2005) define a reference household with income y^R, size n^R, and number of children k^R, and comparison household with income y^C, size n^C, and number of children k^C. Setting equation (10) for the reference and comparison households equal yields:

$$\lambda_1\log\left(\frac{y_{ij}^C}{y_{ij}^R}\right)=\lambda_3\left(\frac{k_{ij}^R}{n_{ij}^R}-\frac{k_{ij}^C}{n_{ij}^C}\right)-\lambda_2\log\left(\frac{n_{ij}^C}{n_{ij}^R}\right) \quad (12)$$

Dividing the right hand side by λ_1 and taking exponents yields the equivalence scales. In this model, the equivalence scale is independent of the income of the reference household (Olken 2005). To extend to multi-year data, we use the conditional fixed-effects logit model, but instead of conditioning out community level fixed effects, we condition out community-year fixed effects. This allows the threshold point for program participation to change for a given community in each time period, however, it assumes that the parameter coefficients are the same for a given community over time (i.e., $\lambda_1, \lambda_2, \lambda_3, \lambda_4$ do not change over time).

3.3 Empirical approach to calculating the intensive margin of participation

After estimating how household demographic structure affects selection into the PSNP (extensive margin of participation), we extend the method to consider whether household demographic structure affects the levels of payments once a family is included in the PSNP (intensive margin of participation). In a sequential model we use the results from (11) as the first stage of a two-stage selection model. We capture the predicted probability of PSNP participation, then convert that predicted probability to an inverse Mill's ratio (IMR) and include the IMR as a control variable in a pooled OLS regression with village-year fixed effects in the second stage. The IMR is calculated as:

$$\Lambda_{ijt} = \frac{\phi(\hat{r}_{ijt})}{\Phi(\hat{r}_{ijt})} \tag{13}$$

where $\phi(\hat{r}_{ijt})$ is the probability distribution function, and $\Phi(\hat{r}_{ijt})$ is the cumulative distribution function of $\hat{r}_{ijt}$, the predicted probability of PSNP participation from (11).[6] The second stage is a pooled OLS regression modeled as:

$$P_{ijt} = \alpha + Family\_Structure_{ijt}'\beta + X_{ijt}'\gamma + J_{tj} + \theta\Lambda_{ijt} + \varepsilon_{ijt} \tag{14}$$

where P_{ijt} is the payment to household *i* at year *t* at village *j* and $Family\_Structure_{ijt}$ is a vector of household characteristics such as number of household members in age categories (ages 0-6, 7-15, 16-60, and 61+) and X_{ijt} is a vector of household characteristics that might affect payments such as annual expenditures, gender and age of household head, marital status, education level, asset holdings, local political connectedness, and household level shocks. J_{tj} is the village-year fixed effect, Λ_{ijt} is the IMR converted from the predicted probability of PSNP participation from the first stage equation, and ε_{ijt} is the error. To account for the non-negative censoring of P_{ijt} the Λ_{ijt}

[6] Note the additional *t* subscript in $\hat{r}_{ijt}$ to denote time since our predicted probabilities come from equation (11) after it is taken to the multi-year extension.

term serves as an estimate of the (otherwise) omitted variable of the probability of selection into the PSNP (Heckman 1979). The variables for local political participation are excluded from the second stage, the coefficients on these variables are statistically significant in the first stage, but if included they are not significant in the second stage. In essence, this means that local political participation can help a household enter the PSNP, but once in the PSNP, local political connections do not alter payment amounts made to households, so those variables serve as an effective instrument to identify the first stage.

The vector β is interpreted as the additional payout per household holding all else constant for one additional person in each of the age categories, it assumes that each person within a given age bracket is assigned the same value for β. The vector γ is interpreted as the additional household payment holding all else constant for an additional unit of each household characteristic, and θ is the coefficient on the IMR.

However, it is important to note that there is no guarantee that communities allocate aid to households using a two-stage sequential process. For example, the very real possibility that local communities receive less funding than the necessary amount to fully fund all qualified participants (combined with local communities' authority to select participants) means communities could simultaneously decide what households are included in the PSNP and their level of payment. In that case the selection into the PSNP and the selection of payment amount would be modeled simultaneously. To model the decision as simultaneous we use a standard tobit model in the form:

$$P_{ijt} = \begin{cases} P_{ijt}^{*} & if \quad P_{ijt}^{*} > 0 \\ 0 & if \quad P_{ijt}^{*} \leq 0 \end{cases} \tag{15}$$

where P_{ijt}^{*} is the latent variable:

$$P_{ijt}^{*} = \alpha + Family\_Structure_{ijt}'\eta + X_{ijt}'\psi + K_{jt} + \varepsilon_{ijt} \tag{16}$$

Where P^*_{ijt} is the latent variable of payment to household I at year t at village j and $Family\_Structure_{ijt}$ and X_{ijt} are vectors of household characteristics as above, K_{jt} is the village-year fixed effect, and μ_{ijt} is the error. We use a J-test (Davidson and MacKinnon 1993) to test which model better fits the data statistically. See Appendix B for a broader discussion of a sequential versus simultaneous model.

3.4 Simulating poverty reduction of decentralized versus centralized implementation

Because the PSNP is part of the government of Ethiopia's overall poverty reduction plan,[7] we simulate four main cases, which can be conceptualized in a 2x2 matrix with the level of funding (limited or full) on one axis and the locus of program control (decentralized vs. centralized) on the other axis. The four cases are: constrained funding and decentralized implementation (what we see in practice), constrained funding and centralized implementation (we give beneficiaries with the highest predicted probability of PSNP inclusion from equation (11) a full payment amount until the district budget is exhausted, then others receive no payment), full funding and decentralized implementation (the community allocation rules with full funding), and full funding and centralized implementation (the program as designed). See Figure 1 for a visual representation.

We calculate the Foster, Greer, and Thorbecke (1984) poverty metrics under each of these simulated scenarios to understand how the actual allocation decisions at the local level affect poverty levels. The FGT metrics are calculated as follows:

$$FGT_\alpha = \frac{1}{N}\sum_{i=1}^{H}\left(\frac{z - y_i}{z}\right)^\alpha \tag{17}$$

[7] The PASDEP (Plan for Accelerated and Sustained Development to End Poverty) launched in 2006 was the Ethiopian government's over-arching poverty reduction strategy. The PSNP is a central pillar of the food security plan, which is a key element of the PASDEP.

where z is the Ethiopian government's poverty line, N is the total number of people in the economy, H is the number of poor (those at or below the poverty line), y_i is individual income (or, expenditures) and α is a sensitivity parameter. As α increases from zero the individuals farther away from the poverty line are given more weight. A higher FGT metric means more poverty in the economy. Expenditures (y_i) include the amount of aid (a_i) received if households received aid.

For any of these calculations we must recover the budget constraint for each district. Unfortunately, we do not have administrative records of the actual resources transferred from the federal level to the district government. We can, nonetheless, construct an estimate of the budget constraint faced by each district using the planning records for the PSNP caseload per district (Ethiopian Ministry of Agriculture and Rural Development 2010a). We generate an estimate of the budget constraint faced in each district by multiplying the planned PSNP caseload with the per capita payment observed in each district. Since surveyed participants were selected randomly from the roster of beneficiaries the average per capita payment received should be equivalent to the average per capita payment across the district. While not perfect, this measure should approximate the budget constraint faced by each district.

4. Data and descriptive statistics

The data are from the Ethiopian Food Security Survey (EFSS), a panel survey collected every two years in the four largest regions[8] of Ethiopia. The Central Statistical Agency (CSA) of Ethiopia collected the data with the support of the International Food Policy Research Institute (IFPRI). The dataset focuses on PSNP implementation areas and comprises 3,689 households in 2006; it expanded to 4,654 households in 2008 and beyond. Starting in 2008, the additional households were given the same questionnaire as the rest of the sample. The surveys take place in the traditional hungry season (June-August), which immediately precedes harvest time (September-October). In subsequent

[8] The four largest regions, which comprise about 84% of Ethiopia's population, are Amhara, Tigray, Oromia, and Southern Nations and Nationalities People's Region (SNNPR).

rounds, the same households were re-surveyed regardless of whether they had joined or left the PSNP.[9]

The survey asked households about their PSNP payments for the previous 17 months,[10] leaving a gap of 7 months with no data every other year. Therefore, the analysis of payments uses a yearly panel from 2006-2009 with the total January-May PSNP payments as the key dependent variable.[11] The recall data of monthly household aid receipts is likely accurate. The PSNP began the process of adding client cards for each beneficiary in 2009/2010. Once client cards we distributed, enumerators were instructed to ask households to produce their PSNP client card during the interview. The client card lists months and payments received (see sample client card in Figure 2). In the 2012 round of data collection about half of the respondents could produce their client card and about half could not and therefore listed payments from recall. Recall payment amounts and payments copied from the client cards had almost identical distributions for the two groups, with the mean payments only 2% different between groups (Berhane et al. 2013).

4.1 Descriptive statistics of program versus non-program participants

Table 1 presents the basic descriptive statistics of the variables used in the analysis that follows.[12] The average non-participant household has about 20% higher expenditures than a PSNP household, not including PSNP payments (12,458 ETB vs. 10,407 ETB). A PSNP household is much more likely to be female headed (25.7% vs. 16.8%), less educated (1.20 vs. 1.06 years completed), and slightly smaller in size (5.31 vs. 5.15).

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[9] See Gilligan et al. (2007) and Gilligan et al. (2009) for a detailed description of the sampling methodology.

[10] The 2006 survey (performed approximately in July) only recounted PSNP payment data for 12 of the 18 months since the program start in January 2005.

[11] PSNP work is designed to occur between January-June (avoiding the primary agricultural season July-December) so the January-May data covers almost all of the scheduled PSNP payments. However, it is noted that arrears in payments occurred in some years (Berhane et al. 2011).

[12] Expenditures and value of productive assets are adjusted to 2009 currency units using World Bank consumer price index data for Ethiopia downloaded at: http://data.worldbank.org/indicator/FP.CPI.TOTL

PSNP households have about one third of a hectare lower land holdings (1.43 vs. 1.13), fewer livestock (4.88 vs. 3.30 tropical livestock units), and less productive equipment (270 ETB vs. 244 ETB). PSNP households have more direct local political connections (12.9% vs. 9.5%) where an immediate family member is a member of the village government. PSNP households also have more extended local political connections (21.7% vs. 18.8%) where a friend or extended relative is a member of the village government. PSNP participants are more likely to have experienced the death of a spouse (2.5% vs. 1.7%) but the likelihood of facing a drought or illness shock is not statistically significantly different between groups. PSNP households have fewer working age adults (46.2% vs. 47.9%) and more elderly (7.9% vs. 6.2%), there is no statistical difference in the demographic composition of older children (24.9% vs. 24.6%) or young children (21.1% vs. 21.2%). A hypothetical "average" PSNP family has 5.15 members and is entitled to an annual payout[13] of 1,545 ETB (5.15 people * 300 ETB/person/year), which is approximately 15% of annual household expenditures. Figure 3 displays a box plot of the PSNP payments received for each household size. While some households do receive their full entitlement, in general as household size increases the median household payment lags considerably compared to the full entitlement.

4.2 Descriptive statistics of district level budget constraints

On average, communities only received 62% of the full amount required to implement the program as per the district planning documents (Ethiopian Ministry of Agriculture and Rural Development 2010a); 89% of communities (69 of 78 districts in our data) received less than the necessary amount, while 11% received more than necessary to implement the program (Figure 4). While there is no publically available administrative records that document the amount of money sent to each district, the PSNP is structured in a way that the level of international donations into the program determines the overall budget. An assessment document of the PSNP by the Independent Evaluation Group of

[13] Because the PSNP payment rate changes throughout the dataset, PSNP payment amounts are normalized to 2009 payment levels. For example this adjustment makes a 65% payment in 2007 (117 ETB when the pay schedule is 180ETB/year) equal to a 65% payment in 2009 (195 ETB when the pay schedule is 300ETB/year).

the World Bank (2006) finds that the program anticipates a funding gap of USD$194.6 million in the 2007-09 period, which is equivalent to more than 20% of the total three year planned budget of USD$915.3 million. It is worth noting, however, that the report states that anticipated gaps can increase or decrease over time as implementation priorities change or more donors contribute funding.

5. Results

We begin by examining the community's selection of participants at the extensive margin, then the intensive margin, followed by poverty simulations comparing locus of control and level of funding.

5.1 Revealed community equivalence scales at the extensive margin of participation

The estimated odds ratios of the revealed community equivalence scales at the extensive margin (based on equation (11)) are presented in Table 2 (the logistic regression results are presented in Appendix Table A1). The specifications are run with (col. 2 and 4) and without household controls (col. 1 and 3). Because communities likely take into account observable characteristics, the preferred specification is with household controls.

Larger households are associated with a higher probability of inclusion into the program as the odds ratio is statistically significantly higher than one in each specification. However, when examining the age structure of households (col. 2), the probability of inclusion in the PSNP is not different between age cohorts (none of the odds ratios are statistically significantly different from one), meaning communities treat all people as equivalent when assigning PSNP status. Because none of the coefficients on the age structure of households are statistically significant, it is not meaningful to calculate an actual set of equivalence scales as per equation (12).

When examining gender differences on the extensive margin (col. 4), there is no sex bias; boys and girls are treated equally (odds ratios are not statistically significantly different from one). However, households with more adult men are less likely to be selected into the PSNP than households with more adult women. Households with higher expenditures

are less likely to be included in the PSNP; households with a marital status of only one spouse (single, divorced, widowed) have higher probabilities of inclusion than married couples (the omitted category). Local political connectedness (having a family member or friend with a position in the village) is associated with a higher probability of inclusion in the program while higher asset holdings (land, livestock) are associated with lower probabilities of program inclusion. Suffering a household shock neither increases nor decreases the probability of inclusion.

These results are markedly different from those found in a similarly structured program in Indonesia. Olken (2005) finds that Indonesian communities allocate aid as if adding an additional child requires an increase of expenditures equal to only 76% of that spent on each of the first two adults. Our results suggest that, unlike in Indonesia, all people are treated as equivalent in determining household aid eligibility in Ethiopia. The one exception to that rule, the fact that having more working age men reduces the likelihood of PSNP participation in spite of working age men's relatively greater consumption requirements, is the first signal that "socially adequate" equivalence scale might be at play rather than one based on consumption needs.

5.2 Revealed community equivalence scales at the intensive margin of participation

The results for the simultaneous model (tobit) are presented in Table 3. The specifications are run with (col. 2 and 4) and without household control variables (col. 1 and 3). The preferred specification is with household controls. A child aged 0-6 (col. 2) receives an estimated 15% more than an adult aged 16-60 (95.2 ETB vs. 83.1 ETB) but this difference is not statistically significantly different from zero. Older children aged 7-15 receive 27% more ($p<0.05$) than adults (105.4 ETB vs. 83.1 ETB). The elderly receive 41% more than working aged adults (116.8 ETB vs. 83.1 ETB), however this difference is not statistically significantly different from zero (likely due to the small sample size of elderly).

When allowing for gender differences (col. 4), girls and boys aged 0-6 receive about the same payment (89.9 ETB vs. 95.0 ETB), girls aged 7-15 receive 34% more ($p<0.05$) than

boys the same age (120.4 ETB vs. 90.1 ETB). Adult working aged women are paid 74% more ($p<0.01$) than working aged men (109.5 ETB vs. 62.8 ETB). Elderly women receive 64% more than elderly men (143.7 ETB vs. 87.7 ETB) but this difference is not statistically significantly different from zero. Further evidence of the "earnings potential" equivalence scale is that adult working aged men (those most likely to be able to find work in the marketplace) have the smallest coefficient estimate (62.8 ETB) of any age gender grouping.[14] The coefficient on adult working aged men is statistically significantly smaller than the coefficient estimate of all other age and gender categories ($p<0.05$), with the exception of young boys aged 0-6 ($p<0.10$) and elderly men.

The sequential model results (Table 4) are less conclusive, though some specifications still suggest that younger age cohorts are paid more than adults. Without accounting for any control variables (recall that the PIM states that once selected into the program all participants should receive the same payment), younger children aged 0-6 (col. 1) receive about the same as children aged 7-15 (81.7 ETB vs. 77.8 ETB) and this is about 9% larger than what working aged adults receive (74.7 ETB). However, none of these estimates are statistically significantly different from each other. Elderly receive a lower payment (54.5 ETB), which is marginally statistically different from children aged 0-6 ($p<0.10$), but not statistically significantly different from other age groups. When including controls (col. 2), young children receive the same as working aged adults (59.0 ETB vs. 60.2 ETB), but older children receive 12% more than working aged adults (67.6 ETB vs. 60.2 ETB), but this difference is not statistically significant either. When splitting age cohorts by gender (col. 4) there are no statistically significant differences

[14] For evidence that women are disadvantaged in labor markets in Africa see Glick and Sahn (1997) who document gender wage gaps where women are paid less than men for the same job in Guinea, and Appleton, Hoddinott, and Krishnan (1999) who document this phenomena for three African countries including Ethiopia. When comparing education levels of the husband and wife within the PSNP data, adult women have much lower education levels than adult men (1.47 years vs. 3.64 years) in households that are not single headed households. See Schultz (2004) for evidence of the wage rate returns to schooling in Africa.

between sexes within the same age cohort, nor are their statistically significant differences across any of the age and gender groups.

5.3 Comparing poverty levels using head count, poverty gap, and poverty gap squared

Now we generate policy simulations to understand the poverty reducing effects of the allocation rules chosen by the communities versus those designed by the central government. The first row of Table 5 presents a counterfactual of poverty levels without the PSNP by examining expenditure data less PSNP payments. Because of a very low propensity to invest PSNP proceeds in productive assets (Gilligan, Hoddinott, and Taffesse 2009; Hoddinott et al. 2012) it is unlikely that PSNP proceeds created a return for households outside of its consumption value, therefore simply subtracting the PSNP proceeds from household expenditures seems a feasible counterfactual of what poverty levels in communities were absent the program. The headcount poverty rate is 0.5879 in this counterfactual scenario, the poverty gap is 0.2181 and the gap-squared measure is 0.1077.

Next, we keep the program budget equal to what we observed in the field and generate two scenarios. One is based on the communities' actual allocation rules and the other mimics the federal implementation mandates by allocated a full and uniform payment to each household member, but allows fewer households into the program based on the observed district budget constraint. We select these households by choosing households that had the highest probability of inclusion in the PSNP according to equation (11).

The actual implementation scenario (row 2) has FGT metrics of 0.5705, 0.2025, and 0.0957 for alphas 0,1,2 respectively. The limited budget and centralized allocation approach (row 3) has FGT metrics of 0.5719, 0.2001, and 0.0934. Using the statistical inference tests developed by Kakwani (1993) neither the head count poverty nor the poverty gap measures are statistically significantly different from the no PSNP program scenario and only the gap-squared measure in the limited budget and centralized allocation approach (row 3) is weakly statistically significantly different ($p<0.10$) from the counterfactual of no PSNP program payments. None of the differences in any metrics

(α=0,1,2) are statistically significantly different between either of the limited funding scenarios.

The fully funded scenarios are presented in the fourth and fifth rows of Table 5. When following the community allocation rules with a full budget (row 4) the FGT metrics are 0.5627, 0.1932 (difference with no PSNP payment scenario (row 1) significant at $p<0.10$), and 0.0893 (difference with no PSNP payment scenario (row 1) significant at $p<0.05$). Following the centralized implementation plan of a full and uniform payment and a full budget (row 5) the FGT metrics are 0.5573, 0.1906 (difference with no PSNP payment scenario (row 1) significant at $p<0.05$), and 0.0876 (difference with no PSNP payment scenario (row 1) significant at $p<0.05$). While the point estimates in the fully funded central allocation scenario (row 5) show slightly lower poverty rates than each estimate in the fully funded but local allocation rules (row 4), none of the differences of any metrics (α=0,1,2) between either of the fully funded scenarios are statistically significantly different from each other.

6. Conclusion

Because communities do not receive sufficient funds to follow the federal implementation mandates of a full and uniform payment to each PSNP beneficiary, communities must instead exercise local discretion in allocating aid. This gives us the chance to examine "socially adequate" consumption levels as determined by the local communities themselves. In order to recover the preferences revealed by communities in how they allocate aid we extend the technique developed by Olken (2005) to include the intensive margin of participation (how much aid paid out) in addition to the extensive margin of participation (whether or not household is included in the aid program). The first key finding of this paper is that the preferences revealed by Ethiopian communities show that they allocate aid in a pro-poor fashion by allocating more aid to underprivileged groups with lower wage earnings potential (e.g., teenage girls vs. teenage boys, adult women vs. adult men, elderly vs. working age adults). This first finding is distinctive in regards to at least two strands of literature.

First, a majority of the literature on equivalence scales (e.g., Engel 1895; Rothbarth 1943; Deaton & Muellbauer 1986; Deaton 1997; Lewbel 1997; OECD 2008; Browning et al. 2013) is based on the underlying assumption that adult equivalence should be calculated based on consumption needs. While basing equivalence scales on consumption is certainly logical (e.g., fixed costs of running a household decline on a per capita basis as the household gets larger due to shared housing, shared electricity, etc.), doing so ignores the preferences of communities in how they define poverty for themselves. Understanding community preferences in the context of a definition of poverty may assist in the long standing challenge for researchers—raised by Pollak and Wales (1979)—of not just equalizing consumption but in actually defining a "socially adequate" consumption level.

One way to recover this "socially adequate" level is to observe how communities make the decision for themselves, such as in the Ethiopian context discussed in this paper or in the Indonesian context described by Olken (2005). When communities are given the opportunity to allocate aid they may signal that other characteristics are more important than consumption in their definition of poverty. We find that Ethiopian communities appear to prioritize factors like limited future earnings potential more than current period consumption. Our finding is similar to Alatas et al. (2012) despite using a different methodological approach. They experimentally compare a community-based targeting method with central government led proxy means testing within a large social assistance program in Indonesia. They find that communities have different preferences than the government as to whom should receive social assistance than the government and that communities prioritize neediness in terms of earnings capacity rather than just consumption.

Second, our finding of pro-poor aid allocations is distinctive in that it shows that decentralized implementation of social assistance programs can lead to pro-poor allocation rules. The Ethiopian case presented in this paper runs contrary to a large body of research that describes how decentralized program implementation are often distributionally regressive (e.g., Reinikka & Svensson 2004; Bardhan & Mookherjee

2006; Galiani et al. 2008; Ricker-Gilbert & Jayne 2012; Lunduka et al. 2013; Kilic et al. 2015).

The second key finding of this paper is that despite the communities' pro-poor implementation, the program does not significantly lower poverty rates due to constrained funding. In simulations with full funding the program significantly reduces the poverty gap and poverty gap-squared measures in *both* the decentralized and centralized implementation even though they use different allocation criteria. This finding is meaningful for at least two reasons.

First, it provides practical operational advice for the Government of Ethiopia and other program implementers that fewer (not additional) resources should be deployed to enforce the full and uniform payment mandate. This insight is potentially quite useful as the Government of Ethiopia highlighted the requirement of local communities to make a full and uniform payment to each member of eligible households in its revised Program Implementation Manual published at the beginning of 2010 (Ethiopian Ministry of Agriculture and Rural Development 2010b). Any funding allocated towards ensuring compliance of this mandate may be more effectively re-deployed towards enlarging the overall program budget, rather than regulating how communities allocate the aid they do receive.

Second, the finding of no difference in poverty rates when comparing centralized versus decentralized implementation dovetails nicely with other recent research. Alatas et al. (2012) found that central government led proxy means tests performed slightly better at identifying the poor than a local community-based approach, but that these differences in targeting were not large enough to make a difference in overall poverty rates. In that study—as in this one—the major policy takeaway is that the overall level of funding is more important for resultant poverty reduction than the locus of control over implementation.

Appendix A: Variance decomposition of payments to participants

Because the per-capita payment is designed to be uniform, there should be no variation in the marginal transfer when increasing household size by one person (conditional on PSNP participation). Therefore, we decompose the variance in marginal payments across the administrative levels of government to determine if (and to what degree) local governments deviate from central implementation mandates.

A.1 Construction of marginal payment variable

The marginal payment for an additional household member is the difference in payment between what a household actually received and the mean payment (conditional on being in the PSNP) in that same *woreda* for a household whose size is larger by one member. The probability density function of the incremental differences in marginal payouts for additional household members is the distribution of:

$$MP_{itw} = (\overline{T_{tw}} \mid H_{tw} = m+1) - (T_{itw} \mid H_{itw} = m) \quad \text{(A.1)}$$

Where $\overline{T_{tw}}$ is the mean transfer for households with size $H_{tw} = m + 1$ in year t and *woreda* w and T_{itw} is the amount of transfer and $H_{itw} = m$ is household size for household i specifically.[15] We symmetrically trim the 1% of outliers from each tail of the marginal payment sample to reduce the effect of outliers.[16]

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[15] This is a one-step-ahead estimator. We also construct a one-step-behind estimator (i.e. $MP_{itw} = (T_{itw}|H_{itw} = m) - (\overline{T_{tw}}|H_{tw} = m - 1)$. Results using the one-step-ahead estimator are presented in the main paper; results using the one-step-behind estimator do not materially change and are presented in Appendix Table A1.

[16] We also calculate additional marginal payment measures using the *kebele* rather than the *woreda* as the reference point. The *kebele* is a lower administrative unit and calculating the marginal payment this way would be advantageous if the *kebele* is the locus of determination in marginal payments. It has the disadvantage, however, of data loss, as there are more boundary problems and more potential gaps in the data when creating the distribution of marginal payments. Additionally, the marginal payment variable is calculated with and without simple non-parametric smoothing to reduce the impact of any outliers in a

A.2 Decomposing the variance of marginal payment

We adapt the nonparametric variance decomposition approach of Barrett and Luseno (2004) to decompose the variance in marginal payments at differing levels of the government structure within the PSNP. The decomposition works as follows. Let *i* index individual households, *k* is the *kebele* (village) location, *w* is the *woreda* (district) location, *z* is the zone location, *r* is the region location, and *f* is the federal level.[17] Simply begin with the obvious statement that marginal payment of a given household equals the marginal payment of that same household.[18]

$$MP_{ikwzrf} = MP_{ikwzrf} \tag{A.2}$$

Then repeatedly add and subtract the same term to the right hand side of equation (A.2) and regroup with parentheses.

$$MP_{ikwzrf} = (MP_{ikwzrf} - \overline{MP_k}) + (\overline{MP_k} - \overline{MP_w}) + (\overline{MP_w} - \overline{MP_z}) + (\overline{MP_z} - \overline{MP_r}) + (\overline{MP_r} - \overline{MP_f}) + \overline{MP_f} \tag{A.3}$$

Equivalently this can be rewritten as:

$$MP_{ikwzrf} = K + W + Z + R + F + \overline{MP_f} \tag{A.4}$$

where $K \equiv (MP_{ikwzrf} - \overline{MP_k})$ is the deviation of household marginal payment from the *kebele* mean marginal payment in the same *kebele*; $W \equiv (\overline{MP_k} - \overline{MP_w})$ is the deviation of

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given *woreda* or *kebele*. Irrespective of the way the marginal payment variable is generated, the qualitative variance decomposition results are largely the same.

[17] The administrative levels of Ethiopian government from the least to the most central are: *kebele* (village), *woreda* (district), zone, region, federal.

[18] The decomposition is executed only on data points from the same year; therefore the year subscript is dropped in the model specification.

kebele mean marginal payment from *woreda* mean marginal payment in the same *woreda*; $Z \equiv (\overline{MP_w} - \overline{MP_z})$ is the deviation of *woreda* mean marginal payment from zonal mean marginal payment in the same zone; $R \equiv (\overline{MP_z} - \overline{MP_r})$ is the deviation of zonal mean marginal payment from regional mean marginal payment in the same region; and, lastly, $F \equiv (\overline{MP_r} - \overline{MP_f})$ is the deviation of regional mean marginal payment from federal mean marginal payment. Taking the variance of equation (A.4) gives the following decomposition:

$$\begin{aligned} Var(MP_{ikwzrf}) = {} & Var(K) + Var(W) + Var(Z) + Var(R) + Var(F) + \\ & 2[Cov(K,W) + Cov(K,Z) + Cov(K,R) + Cov(K,F) + Cov(W,Z) + \\ & Covs(W,R) + Cov(W,F) + Cov(Z,R) + Cov(Z,F) + Cov(R,F)] \end{aligned} \tag{A.5}$$

Simplification and splitting the covariance shares equally between the two components leads to the following five sources of variation in marginal payments:

$$KS \equiv Var(K) + Cov(K,W) + Cov(K,Z) + Cov(K,R) + Cov(K,F) \tag{A.6}$$

is the *kebele* (village) source variation,

$$WS \equiv Var(W) + Cov(K,W) + Cov(W,Z) + Cov(W,R) + Cov(W,F) \tag{A.7}$$

is the *woreda* (district) source variation,

$$ZS \equiv Var(Z) + Cov(K,Z) + Cov(W,Z) + Cov(Z,R) + Cov(Z,F) \tag{A.8}$$

is the zonal source variation,

$$RS \equiv Var(R) + Cov(K,R) + Cov(W,R) + Cov(Z,R) + Cov(R,F) \tag{A.9}$$

is the regional source variation, and

$$FS \equiv Var(F) + Cov(K,F) + Cov(W,F) + Cov(Z,F) + Cov(R,F) \qquad \text{(A.10)}$$

is the federal source variation. Substituting these five variables into equation (A.5) and dividing both sides by $Var(MP_{ikwzrf})$ gives a decomposition of the sources of variation of marginal payment:

$$1 = ks + ws + zs + rs + fs \qquad \text{(A.11)}$$

where the lower case variables are shares of variation from each source.

A.3 Variance decomposition of marginal payment

The federally mandated uniform benefit schedule implies zero variance across the sample because marginal annual wage payment is uniform in a given year.[19] However, the variance decomposition (Appendix Table A2) shows that the largest share of variance in marginal payment is concentrated at the *kebele* (village) (ks) level (61.6% to 79.8%), followed by the *woreda* (district) (ws) (16.7% to 35.6%). In short, there is considerable variation in marginal PSNP payments and local governments account for most of that variation. Results are robust to whether the marginal payment variable is calculated with the *woreda* or *kebele* as the reference point. It appears that the actual payment schedule is largely determined in a decentralized manner at the most local level of government and does not follow the uniform payment schedule stipulated by the central government.

[19] Recall the daily wage rage in 2006-07 was 6 ETB/day (6 ETB/day*5 days/month*6 months = 180 ETB/person/year), 2008 wages were 8 ETB/day (8 ETB/day*5 days/month* 6 months = 240 ETB/person/year) and in 2009 was 10 ETB/day (10 ETB/day*5 days/month*6 months = 300 ETB/person/year). Direct support beneficiaries receive the same payment allocation with no work requirement.

Appendix B: Simultaneous vs. sequential model for determining community equivalence scales at the intensive margin

Because households that receive PSNP payments are not randomly selected, a selection model with censoring at zero is necessary to estimate the value of parameters associated with household demographic structure at the intensive margin of participation. Deciding on an appropriate selection model, however, raises an ancillary but important question; do rural Ethiopian communities make decisions about the extensive and intensive margins of participation in the PSNP sequentially or simultaneously? Based on the project implementation manual, we might expect a sequential two-stage process where households are initially chosen for inclusion to the PSNP and then households receive the federally mandated fixed per capita payment in a second stage. However, this is unlikely the case if communities have less funding than necessary to implement as per the PIM. We find that communities, on average, only received 62% of the funds necessary to implement as per the instructions in the PIM. Furthermore, World Bank appraisal documents highlight international donor funding shortfalls of more than 20% for the PSNP (World Bank 2006). In a constrained setting like this, it seems highly probable that communities make decisions about the extensive and intensive margins of PSNP participation simultaneously to account for the shortfall in budget (e.g., the community includes a household in the program, but does so knowing they will assign the household fewer work days and a lower level of payment).

Therefore we test the hypothesis that local communities simultaneously determine participation in the PSNP and PSNP payment amounts. To do this, we adapt the technique proposed by Bellemare and Barrett (2006) and model payment levels at the intensive margin both sequentially (equation (14)) and simultaneously (equation (16)) and then use a sequential J-test (Davidson and MacKinnon 1993) to see if we can reject the simultaneous hypothesis.

B.1 Results of J-test

We obtain the predicted values for the sequential (2 step) model and include them as regressors in the simultaneous (tobit) model. We obtain the predicted values for the simultaneous (tobit) model and include them as regressors in the sequential (2 step) model. The null hypotheses are: (1) the estimated coefficient for the predicted value of the sequential model is not statistically significantly different from zero in the simultaneous model and (2) the estimated coefficient for the predicted value of the simultaneous model is not statistically significantly different from zero in the sequential model. These test, respectively, that (1) the sequential model has no explanatory power with respect to the simultaneous model, and (2) the simultaneous model has no explanatory power with respect to the sequential model. The coefficient estimate for (1) is 5.72 with a t-statistic of 9.24 ($p<0.000$), and the coefficient estimate for (2) is -0.48 with a t-statistic of -4.39 ($p<0.000$). Therefore we cannot reject the hypothesis that local communities simultaneously determine participation in the PSNP and PSNP payment amounts. As such, we focus on the results of the simultaneous model (tobit) in determining community equivalence scales.

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Table 1
Descriptive Statistics

	PSNP Status		
	Non-Participant	Participant	Difference
Total household expenditures, birr/year	12457.9	10406.8	2051.1***
	(8093.8)	(7247.2)	(125.3)
Age of household head	46.18	46.77	-0.589*
	(14.87)	(15.05)	(0.243)
Female headed household	0.168	0.257	-0.0895***
	(0.374)	(0.437)	(0.00660)
Household head highest grade attained	1.200	1.062	0.139***
	(2.299)	(2.145)	(0.0362)
Household size	5.312	5.147	0.164***
	(2.111)	(2.151)	(0.0347)
Percent children aged 0-6	0.212	0.211	0.00183
	(0.188)	(0.187)	(0.00305)
Percent children aged 7-15	0.246	0.249	-0.00283
	(0.188)	(0.193)	(0.00310)
Percent adults aged 16-60	0.479	0.462	0.0175***
	(0.210)	(0.217)	(0.00347)
Percent adults aged 61+	0.0622	0.0787	-0.0165***
	(0.159)	(0.191)	(0.00285)
Landholdings in hectares	1.430	1.158	0.272***
	(1.258)	(1.002)	(0.0186)
Livestock in tropical livestock units	4.897	3.298	1.599***
	(5.474)	(3.550)	(0.0757)
Household member has position in *kebele*	0.0953	0.129	-0.0340***
	(0.294)	(0.336)	(0.00512)
Friend or relative has position in *kebele*	0.188	0.217	-0.0282***
	(0.391)	(0.412)	(0.00653)
Value of productive equipment, birr	269.9	244.2	25.68***
	(319.3)	(309.0)	(5.118)
Drought mentioned as most important shock	0.492	0.494	-0.00242
	(0.500)	(0.500)	(0.00814)
Death of a spouse	0.0169	0.0248	-0.00792***
	(0.129)	(0.156)	(0.00232)
Crops suffered from illness of household member	0.102	0.104	-0.00271
	(0.302)	(0.306)	(0.00495)
Observations	7,867	7,250	

Note: Data is pooled from 2006-2009. Variables measured in currency are adjusted according to consumer price index and are listed in 2009 equivalent currency units. Household expenditures do not include payments from PSNP program. Household expenditures and value of productive equipment have the top and bottom 1% of observations removed. The mean and standard deviation by participant status is presented in the first two columns, the difference between non-participants and participants and standard error is presented in the third column. Difference between non-participants and participants significant at *** p<0.01, ** p<0.05, * p<0.1

Table 2

Extensive Margin of PSNP participation (2006-2009), logistic regression results presented as odds ratios

	(1) FE logit	(2) FE logit	(3) FE logit	(4) FE logit
Log annual household expenditures	0.41***	0.51***	0.41***	0.51***
	(0.03)	(0.03)	(0.03)	(0.03)
Log household size	1.22*	2.30***	1.27**	2.36***
	(0.13)	(0.27)	(0.13)	(0.28)
Percent children aged 0-6	1.06	0.63		
	(0.27)	(0.21)		
Percent children aged 7-15	1.29	0.82		
	(0.32)	(0.25)		
Percent adults aged 16-60	0.73*	0.72		
	(0.13)	(0.16)		
Percent boys aged 0-6			0.89	0.58
			(0.26)	(0.21)
Percent girls aged 0-6			1.12	0.61
			(0.33)	(0.21)
Percent boys aged 7-15			1.00	0.69
			(0.27)	(0.24)
Percent girls aged 7-15			1.48	0.87
			(0.40)	(0.29)
Percent men aged 16-60			0.55***	0.58**
			(0.12)	(0.16)
Percent women aged 16-60			0.93	0.85
			(0.19)	(0.21)
Household head highest grade attained		1.00		1.00
		(0.00)		(0.00)
Marital Status: Single		1.99***		1.99***
		(0.51)		(0.50)
Marital Status: Divorced		2.08***		2.07***
		(0.36)		(0.36)
Marital Status: Widowed		1.82***		1.81***
		(0.20)		(0.20)
Household member has position in *kebele*		1.95***		1.95***
		(0.21)		(0.21)
Friend or relative has position in *kebele*		1.38***		1.39***
		(0.11)		(0.11)
Landholdings in hectares		0.88***		0.87***
		(0.03)		(0.03)
Livestock in tropical livestock units		0.85***		0.85***
		(0.02)		(0.02)
Value of productive equipment (100's birr)		0.99		0.99
		(0.01)		(0.01)
Drought mentioned as most important shock		1.02		1.02
		(0.08)		(0.08)
Death of a spouse		1.20		1.20
		(0.21)		(0.21)
Crops suffered from illness of household member		1.04		1.04
		(0.09)		(0.09)
Kebele-year fixed effects	Yes	Yes	Yes	Yes
Observations	15,548	13,645	15,548	13,645
Chi-square test	224.5	294.1	237.8	320.3
Prob > chi^2	0.000	0.000	0.000	0.000
Pseudo R^2	0.041	0.101	0.042	0.101

Standard errors clustered at *kebele* level, presented in exponentiated form

*** p<0.01, ** p<0.05, * p<0.1

Note: The data is pooled from Jan.-May of years 2006-2009. Variables measured in currency are adjusted according to consumer price index and listed in 2009 equivalent currency units. Expenditures and value of productive equipment have the top and bottom 1% removed. Marital status is categorical with married as omitted category. Age of household head included in regression, but with small and statistically insignificant coefficient, so removed from table due to space constraints.

Table 3
Simultaneous Model of Intensive Margin of PSNP participation

	(1) Tobit	(2) Tobit	(3) Tobit	(4) Tobit
Annual household expenditures (100's birr)	-2.60***	-2.02***	-2.55***	-2.01***
	(0.17)	(0.16)	(0.17)	(0.16)
Number children aged 0-6	79.30***	95.20***		
	(7.85)	(8.32)		
Number children aged 7-15	77.15***	105.41***		
	(6.84)	(7.20)		
Number of adults aged 16-60	31.94***	83.13***		
	(7.35)	(7.91)		
Number adults aged 61+	33.69**	116.82***		
	(16.34)	(22.21)		
Number boys aged 0-6			75.97***	89.91***
			(10.44)	(10.77)
Number girls aged 0-6			79.49***	94.97***
			(10.15)	(10.38)
Number of boys aged 7-15			57.25***	90.14***
			(9.36)	(9.65)
Number of girls aged 7-15			99.69***	120.36***
			(9.74)	(9.83)
Number men aged 16-60			4.33	62.82***
			(9.85)	(10.39)
Number women aged 16-60			79.19***	109.45***
			(11.97)	(11.77)
Number men aged 61+			-35.60	87.74***
			(22.45)	(28.77)
Number women aged 61+			122.22***	143.67***
			(26.40)	(29.48)
Household head highest grade attained		-9.43**		-8.40**
		(3.68)		(3.69)
Marital Status: Single		200.26***		194.97***
		(60.11)		(59.75)
Marital Status: Divorced		120.00***		109.13***
		(30.86)		(30.80)
Marital Status: Widowed		116.32***		97.62***
		(23.32)		(24.48)
Household member has position in *kebele*		221.13***		219.85***
		(24.07)		(24.09)
Friend or relative has position in *kebele*		99.60***		99.71***
		(22.00)		(21.98)
Landholdings in hectares		-24.88		-24.69
		(16.62)		(16.48)
Livestock in tropical livestock units		-55.72***		-55.18***
		(5.02)		(5.00)
Value of productive equipment (100's birr)		-3.47		-2.87
		(3.06)		(3.05)
Death of a spouse		142.24***		150.29***
		(52.42)		(52.95)
Kebele-year fixed effects	Yes	Yes	Yes	Yes
Observations	13,645	13,645	13,645	13,645
F-test	4.280	4.650	4.281	4.660
Prob > F	0.000	0.000	0.000	0.000
Pseudo R^2	0.030	0.037	0.031	0.037

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Dependent variable is PSNP payments made between Jan.-May in years 2006-2009. Variables measured in currency are adjusted according to consumer price index and listed in 2009 equivalent currency units. Expenditures and value of productive equipment have the top and bottom 1% removed. Marital status is categorical with married as omitted category. Drought and illness of family member mentioned as important shocks were included in regressions, but results were small and statistically insignificant, therefore they are removed from this table for space.

Table 4
Sequential Model of Intensive Margin of PSNP participation

	(1) 2nd Stage	(2) 2nd Stage	(3) 2nd Stage	(4) 2nd Stage
Number children aged 0-6	81.74***	58.99***		
	(10.83)	(9.34)		
Number children aged 7-15	77.77***	67.62***		
	(7.84)	(8.16)		
Number of adults aged 16-60	74.65***	60.17***		
	(7.59)	(8.13)		
Number adults aged 61+	54.48***	55.65***		
	(15.48)	(19.85)		
Number boys aged 0-6			80.51***	56.99***
			(12.64)	(10.81)
Number girls aged 0-6			80.90***	58.81***
			(11.98)	(11.18)
Number of boys aged 7-15			79.36***	70.18***
			(10.12)	(9.89)
Number of girls aged 7-15			74.78***	63.48***
			(9.96)	(10.75)
Number men aged 16-60			84.00***	69.68***
			(10.23)	(10.55)
Number women aged 16-60			59.64***	46.59***
			(10.41)	(10.94)
Number men aged 61+			73.06***	63.06***
			(20.18)	(24.01)
Number women aged 61+			30.43	47.72
			(28.82)	(29.54)
Annual household expenditures (100's birr)		-0.01		0.01
		(0.17)		(0.16)
Household head highest grade attained		-4.18		-4.40
		(3.16)		(3.22)
Marital Status: Single		-35.33		-38.46
		(47.40)		(47.45)
Marital Status: Divorced		-180.88***		-180.41***
		(44.12)		(44.41)
Marital Status: Widowed		-137.05***		-134.02***
		(27.38)		(29.42)
Landholdings in hectares		37.03*		37.64*
		(20.64)		(20.64)
Livestock in tropical livestock units		10.07***		10.39***
		(3.55)		(3.43)
Value of productive equipment (100's birr)		-2.98		-3.22
		(5.71)		(5.68)
Drought mentioned as most important shock		-2.53		-3.19
		(19.46)		(19.56)
Death of a spouse		80.73		79.59
		(51.18)		(51.20)
Crops suffered from illness of household member		-31.85		-32.40
		(24.87)		(24.64)
Inverse Mills Ratio	-87.51***	-295.83***	-96.98***	-303.91***
	(29.99)	(69.87)	(32.76)	(67.47)
Kebele-year fixed effects	Yes	Yes	Yes	Yes
Observations	6,728	6,728	6,728	6,728
R-squared	0.65	0.66	0.65	0.66

Standard errors clustered at *kebele* level
*** p<0.01, ** p<0.05, * p<0.1

Note: Dependent variable is PSNP payments made between Jan.-May in years 2006-2009. PSNP payments and currency based variables are adjusted according to consumer price index and are listed in 2009 equivalent currency units. Expenditures and value of productive equipment have the top and bottom 1% removed. Marital status is a categorical variable with married as the omitted category. The local political participation variables are used in the first stage, but are excluded in the second stage.

Table 5
Poverty metrics comparing various simulated scenarios of PSNP implementation

	α=0	**α=1**	**α=2**
Counterfactural: No PSNP payments	0.5879	0.2181	0.1077
	(0.0211)	(0.0122)	(0.0077)
Decentralized and Limited Budget: program as implemented	0.5705	0.2025	0.0957
	(0.0217)	(0.0116)	(0.0069)
Centralized and Limited Budget: fewer people, full and uniform payment	0.5719	0.2001	0.0934*
	(0.0217)	(0.0113)	(0.0067)
Decentralized and Full Budget: community allocation rules, full budget	0.5627	0.1932*	0.0893**
	(0.0218)	(0.0112)	(0.0065)
Centralized and Full Budget: program as envisioned	0.5573	0.1906**	0.0876**
	(0.0217)	(0.0112)	(0.0065)

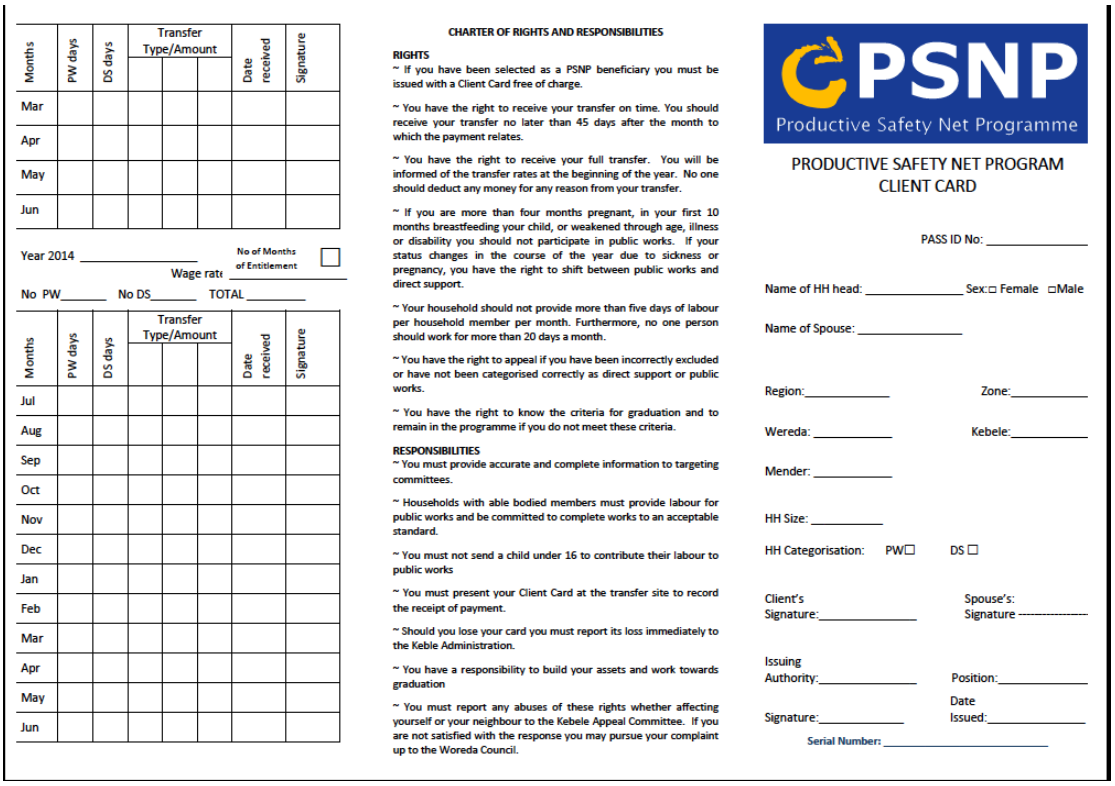
Note: The table examines simulated scenarious of limited and full funding, and centralized versus decentralized program control. Poverty metrics are calculated based on Foster, Greer, Thorbecke (1984) and official Ethiopian government poverty lines. The statistical inference between poverty measures and the counterfactual of no PSNP payments is calculated with a one-sided test based on Kakwani (1993), significance levels for this test are: ** $p<0.05$, * $p<0.10$. The estimates and standard errors take into account sampling weights. When $\alpha=0$ the FGT metric is share of population under the head count poverty line. When $\alpha=1$ the FGT metric is the poverty gap, and when $\alpha=2$ the FGT metric is the poverty gap squared. When comparing poverty metrics between the two limited budget scenarios, neither of the metrics are statistically significantly different from each other. This is also the case when comparing poverty metrics between the two full budget scenarios.

Figure 1
Overview of simulated policy scenarios

Locus of Program Control	Level of Funding: **Limited Budget**	**Full Budget**
Decentralized	Observed in Practice: Community Allocation Rules and Limited Budget	Simulated Scenario: Community Allocation Rules with a Full Budget
Centralized	Simulated Scenario: Fewer People Get Full and Uniform Payment	Simulated Scenario: Central Design, All Participants Get Full and Uniform Payment

Figure 2
PSNP Client Card

ANNEX 6: PSNP CLIENT CARD



Months	PW days	DS days	Transfer Type/Amount			Date received	Signature
Mar							
Apr							
May							
Jun							

Year 2014 _____ No of Months of Entitlement ☐
Wage rate _____
No PW_____ No DS_____ TOTAL _____

Months	PW days	DS days	Transfer Type/Amount			Date received	Signature
Jul							
Aug							
Sep							
Oct							
Nov							
Dec							
Jan							
Feb							
Mar							
Apr							
May							
Jun							

CHARTER OF RIGHTS AND RESPONSIBILITIES

RIGHTS

~ If you have been selected as a PSNP beneficiary you must be issued with a Client Card free of charge.

~ You have the right to receive your transfer on time. You should receive your transfer no later than 45 days after the month to which the payment relates.

~ You have the right to receive your full transfer. You will be informed of the transfer rates at the beginning of the year. No one should deduct any money for any reason from your transfer.

~ If you are more than four months pregnant, in your first 10 months breastfeeding your child, or weakened through age, illness or disability you should not participate in public works. If your status changes in the course of the year due to sickness or pregnancy, you have the right to shift between public works and direct support.

~ Your household should not provide more than five days of labour per household member per month. Furthermore, no one person should work for more than 20 days a month.

~ You have the right to appeal if you have been incorrectly excluded or have not been categorised correctly as direct support or public works.

~ You have the right to know the criteria for graduation and to remain in the programme if you do not meet these criteria.

RESPONSIBILITIES

~ You must provide accurate and complete information to targeting committees.

~ Households with able bodied members must provide labour for public works and be committed to complete works to an acceptable standard.

~ You must not send a child under 16 to contribute their labour to public works

~ You must present your Client Card at the transfer site to record the receipt of payment.

~ Should you lose your card you must report its loss immediately to the Keble Administration.

~ You have a responsibility to build your assets and work towards graduation

~ You must report any abuses of these rights whether affecting yourself or your neighbour to the Kebele Appeal Committee. If you are not satisfied with the response you may pursue your complaint up to the Woreda Council.

PSNP
Productive Safety Net Programme

PRODUCTIVE SAFETY NET PROGRAM
CLIENT CARD

PASS ID No: _____

Name of HH head: _____ Sex:□ Female □Male

Name of Spouse: _____

Region:_____ Zone:_____

Wereda: _____ Kebele:_____

Mender: _____

HH Size: _____

HH Categorisation: PW☐ DS ☐

Client's Signature:_____ Spouse's: Signature ----------

Issuing Authority:_____ Position:_____

Signature:_____ Date Issued:_____

Serial Number: _____

HH Head PIC

Spouse PIC

Year 2010 _____ No of Months of Entitlement ☐
Wage rate _____
No PW_____ No DS_____ TOTAL _____

Months	PW days worked	DS days eligible	Transfer Type/Amount			Date received	Signature
Jul							
Aug							
Sep							
Oct							
Nov							
Dec							
Jan							
Feb							
Mar							
Apr							
May							
Jun							

Year 2011 _____ No of Months of Entitlement ☐
Wage rate _____
No PW_____ No DS_____ TOTAL _____

Months	PW days	DS days	Transfer Type/Amount			Date received	Signature
Jul							
Aug							
Sep							
Oct							
Nov							
Dec							
Jan							
Feb							
Mar							
Apr							
May							
Jun							

Year 2012 _____ No of Months of Entitlement ☐
Wage rate _____
No PW_____ No DS_____ TOTAL _____

Months	PW days	DS days	Transfer Type/Amount			Date received	Signature
Jul							
Aug							
Sep							

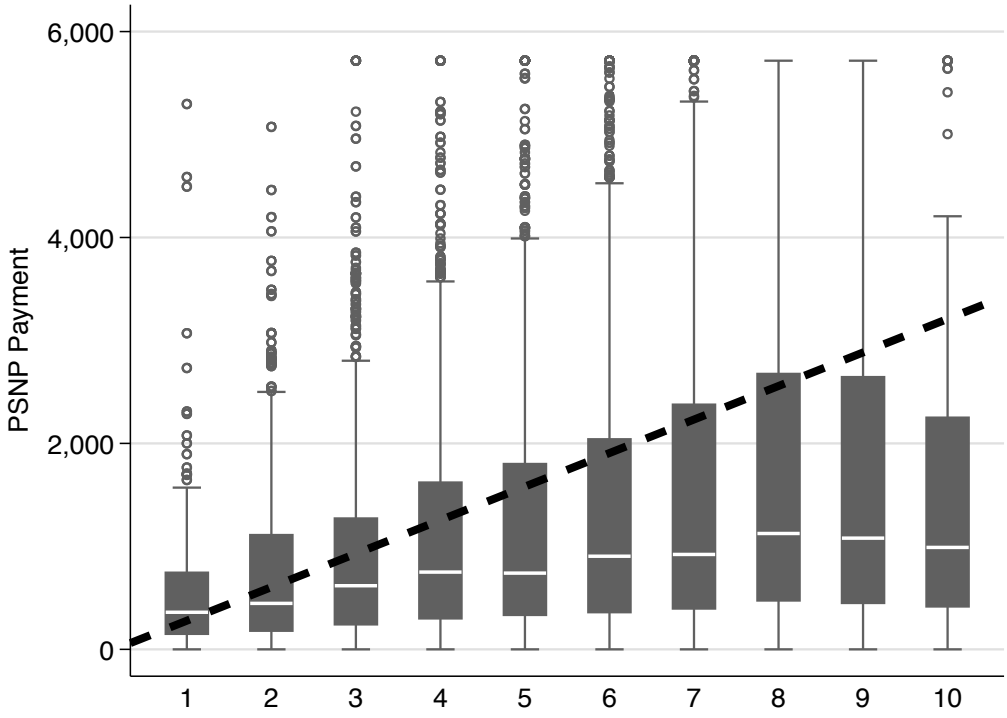
Months	PW days	DS days	Transfer Type/Amount			Date received	Signature
Oct							
Nov							
Dec							
Jan							
Feb							
Mar							
Apr							
May							
Jun							

Year 2013 _____ No of Months of Entitlement ☐
Wage rate _____
No PW_____ No DS_____ TOTAL _____

Months	PW days	DS days	Transfer Type/Amount			Date received	Signature
Jul							
Aug							
Sep							
Oct							
Nov							
Dec							
Jan							
Feb							

Figure 3

Box plot showing distribution of PSNP payment by household size compared to household entitlement



Data includes all payments from 2006-2009. The dashed line is the entitlement of 300 ETB per person. Payments are scaled to be in 2009 payment equivalents (for example, a payment of 90 ETB when the payment schedule calls for 180 ETB is scaled to 150 ETB out of 300 ETB, which is the full payment schedule for 2009). Payments are top and bottom coded at 2%. The while vertical line in the box plot represents the median value, the ends of the solid rectangles represent the 75th and 25th percenticles of the distribution for that household size. The lines extending from the solid rectangles are 1.5 times the interquartile range, and the dots outside of those lines are extreme values.

Figure 4
Histogram of share of distict budget received versus needed according to planning documents. Approximately 89% of districts did not receive sufficient funds to implement as per the planning documents.

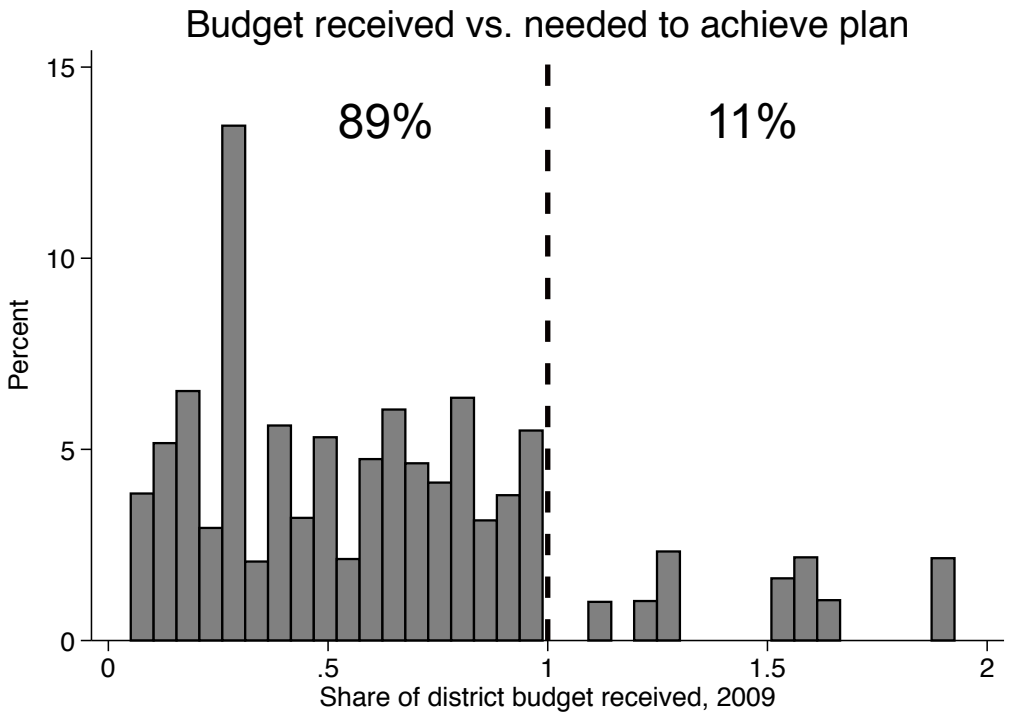


Table A1

Extensive Margin of PSNP participation (2006-2009), logistic regression results

	(1) FE logit	(2) FE logit	(3) FE logit	(4) FE logit
Log annual household expenditures	-0.90***	-0.67***	-0.90***	-0.67***
	(0.06)	(0.06)	(0.06)	(0.06)
Log household size	0.20*	0.83***	0.24**	0.86***
	(0.10)	(0.12)	(0.10)	(0.12)
Percent children aged 0-6	0.06	-0.45		
	(0.26)	(0.32)		
Percent children aged 7-15	0.26	-0.20		
	(0.25)	(0.31)		
Percent adults aged 16-60	-0.32*	-0.33		
	(0.18)	(0.23)		
Percent boys aged 0-6			-0.12	-0.54
			(0.29)	(0.36)
Percent girls aged 0-6			0.12	-0.50
			(0.29)	(0.34)
Percent boys aged 7-15			-0.00	-0.37
			(0.27)	(0.34)
Percent girls aged 7-15			0.39	-0.14
			(0.27)	(0.33)
Percent men aged 16-60			-0.61***	-0.55**
			(0.23)	(0.28)
Percent women aged 16-60			-0.07	-0.17
			(0.21)	(0.25)
Household head highest grade attained		-0.00		-0.00
		(0.02)		(0.02)
Marital Status: Single		0.69***		0.69***
		(0.25)		(0.25)
Marital Status: Divorced		0.73***		0.73***
		(0.17)		(0.17)
Marital Status: Widowed		0.60***		0.59***
		(0.11)		(0.11)
Household member has position in *kebele*		0.67***		0.67***
		(0.11)		(0.11)
Friend or relative has position in *kebele*		0.32***		0.33***
		(0.08)		(0.08)
Landholdings in hectares		-0.13***		-0.13***
		(0.04)		(0.04)
Livestock in tropical livestock units		-0.17***		-0.17***
		(0.03)		(0.03)
Value of productive equipment (100's birr)		-0.01		-0.01
		(0.01)		(0.01)
Drought mentioned as most important shock		0.02		0.02
		(0.08)		(0.08)
Death of a spouse		0.18		0.18
		(0.18)		(0.18)
Crops suffered from illness of household member		0.04		0.04
		(0.09)		(0.09)
Kebele-year fixed effects	Yes	Yes	Yes	Yes
Observations	15,548	13,645	15,548	13,645
Chi-square test	224.5	294.1	237.8	320.3
Prob > chi^2	0.000	0.000	0.000	0.000
Pseudo R^2	0.041	0.101	0.042	0.101

Standard errors clustered at *kebele* level

*** p<0.01, ** p<0.05, * p<0.1

Note: The data is pooled from Jan.-May of years 2006-2009. Variables measured in currency are adjusted according to consumer price index and listed in 2009 equivalent currency units. Expenditures and value of productive equipment have the top and bottom 1% removed. Marital status is categorical with married as omitted category. Age of household head included in regression, but with small and statistically insignificant coefficient, so removed from table due to space constraints.

Table A2

Decomposition of Source Variation in Marginal Payments: Productive Safety Net Program (PSNP)

	kebele **source (ks)**	***woreda*** **source (ws)**	**zonal source (zs)**	**regional source (rs)**	**federal source (fs)**	**sample size (N)**
Kebele as reference point, step ahead	0.9160	0.0301	0.0346	0.0173	0.0020	1327
Kebele as reference point, step behind	0.9281	0.0286	0.0207	0.0202	0.0023	1327
Kebele as reference point, step ahead, smoothed	0.7786	0.0797	0.0873	0.0494	0.0050	1262
Kebele as reference point, step behind, smoothed	0.7829	0.0898	0.0551	0.0690	0.0033	1259
Woreda as reference point, step ahead	0.7976	0.1667	0.0208	0.0125	0.0023	1560
Woreda as reference point, step behind	0.7150	0.2455	0.0210	0.0174	0.0011	1540
Woreda as reference point, step ahead, smoothed	0.7949	0.0297	0.0903	0.0721	0.0129	1552
Woreda as reference point, step behind, smoothed	0.7315	0.0546	0.1119	0.0981	0.0038	1532
Average Source Variation (2006)	**0.8056**	**0.0906**	**0.0552**	**0.0445**	**0.0041**	**1420**

	kebele **source (ks)**	***woreda*** **source (ws)**	**zonal source (zs)**	**regional source (rs)**	**federal source (fs)**	**sample size (N)**
Kebele as reference point, step ahead	0.8739	0.0500	0.0518	0.0138	0.0104	1690
Kebele as reference point, step behind	0.8719	0.0535	0.0509	0.0131	0.0106	1679
Kebele as reference point, step ahead, smoothed	0.7480	0.0901	0.1179	0.0271	0.0168	1570
Kebele as reference point, step behind, smoothed	0.6863	0.1167	0.1438	0.0326	0.0207	1569
Woreda as reference point, step ahead	0.7148	0.2304	0.0238	0.0084	0.0226	2065
Woreda as reference point, step behind	0.6935	0.2613	0.0254	0.0111	0.0086	1994
Woreda as reference point, step ahead, smoothed	0.6859	0.0712	0.1028	0.0329	0.1071	2059
Woreda as reference point, step behind, smoothed	0.6865	0.0396	0.1546	0.0621	0.0572	1987
Average Source Variation (2007)	**0.7451**	**0.1141**	**0.0839**	**0.0251**	**0.0318**	**1827**

Table A2, continuation

Decomposition of Source Variation in Marginal Payments: Productive Safety Net Program (PSNP)

	***kebele* source (ks)**	***woreda* source (ws)**	**zonal source (zs)**	**regional source (rs)**	**federal source (fs)**	**sample size (N)**
Kebele as reference point, step ahead	0.8869	0.0670	0.0197	0.0150	0.0114	1702
Kebele as reference point, step behind	0.8742	0.0699	0.0325	0.0106	0.0129	1694
Kebele as reference point, step ahead, smoothed	0.7952	0.1178	0.0388	0.0307	0.0174	1588
Kebele as reference point, step behind, smoothed	0.8021	0.0982	0.0675	0.0157	0.0165	1584
Woreda as reference point, step ahead	0.7336	0.2389	0.0139	0.0048	0.0087	2091
Woreda as reference point, step behind	0.6690	0.3031	0.0127	0.0050	0.0102	2001
Woreda as reference point, step ahead, smoothed	0.7855	0.0451	0.0919	0.0273	0.0502	2083
Woreda as reference point, step behind, smoothed	0.6902	0.0615	0.1238	0.0404	0.0841	1996
Average Source Variation (2008)	**0.7796**	**0.1252**	**0.0501**	**0.0187**	**0.0264**	**1842**

	***kebele* source (ks)**	***woreda* source (ws)**	**zonal source (zs)**	**regional source (rs)**	**federal source (fs)**	**sample size (N)**
Kebele as reference point, step ahead	0.8519	0.0762	0.0361	0.0289	0.0069	1553
Kebele as reference point, step behind	0.8681	0.0631	0.0389	0.0224	0.0075	1511
Kebele as reference point, step ahead, smoothed	0.7272	0.1155	0.0781	0.0667	0.0124	1414
Kebele as reference point, step behind, smoothed	0.7605	0.1011	0.0770	0.0500	0.0115	1385
Woreda as reference point, step ahead	0.6162	0.3562	0.0190	0.0052	0.0033	1938
Woreda as reference point, step behind	0.6007	0.3688	0.0103	0.0136	0.0065	1840
Woreda as reference point, step ahead, smoothed	0.7769	0.0575	0.1188	0.0287	0.0180	1922
Woreda as reference point, step behind, smoothed	0.6782	0.0606	0.0969	0.1130	0.0513	1824
Average Source Variation (2009)	**0.7350**	**0.1499**	**0.0594**	**0.0411**	**0.0147**	**1673**

Source: calculations based on program payouts from the Ethiopian Food Security Survey

Note: For a given household the marginal PSNP payment is calculated by finding the difference between that household's payment and the mean payment of households in the same location that differed in size by one member. Within each year, rows 1,3,5,7 use a one-step-ahead estimator (rows 2,4,6,8 use a one-step-behind estimator). For example, a one-step-ahead (one-step-behind) estimator compares the actual payment of a participant household of size 4 with the mean payment received of participant households of size 5 (size 3) in the same geographic location. The reference location is either the *kebele* (rows 1,2,3,4) or *woreda* (rows 5,6,7,8). Simple non-parametric local smoothing is used to reduce the effect of outliers (rows 3,4,7,8) while no smoothing is used in rows 1,2,5,6. The sample includes all payments to households for the five month period (Jan.-May) each year and removes outliers (the top 1% and bottom 1% of marginal payments).