How Accurate is Food-for-Work Self-Targeting in the Presence of Imperfect Factor Markets? Evidence from Ethiopia

CHRISTOPHER B. BARRETT
and DANIEL C. CLAY

Effective targeting of transfers is a key issue in public policy to combat poverty. Much faith is presently placed in self-targeting mechanisms such as public employment schemes supported by food-for-work transfers. Where targeting errors have been observed, these are usually attributed to mismanagement of key operational details, such as the project's wage rate. Using a unique data set from rural Ethiopia, we demonstrate that targeting errors may also have structural causes in some low-income countries. We hypothesise that imperfect factor markets generate a predictable dispersion across households in reservation wage rates that breaks down the unconditionally positive relation between income and shadow wages on which the theory of self-targeting public employment programmes rests. Our results confirm that the inaccuracy of FFW targeting stems from the fact that, in rural Ethiopia, higher income households are endowed with more labour per unit of land or animal. Due to poor factor markets in land and livestock these labour-abundant households have lower marginal labour productivity on farm, thereby depressing the reservation wage rates they find acceptable for FFW participation.

Christopher B. Barrett, Department of Applied Economics and Management, Cornell University; Daniel C. Clay, Institute for International Agriculture, Michigan State University. Seniority of authorship is shared equally. Barrett is the corresponding author at 315 Warren Hall, Cornell University, Ithaca, NY 14853-7801, email: cbb2@cornell.edu. The authors thank Stein Holden, Daniel Molla, David Pelletier, Menno Pradhan, David Sahn, Scott Swinton, Amare Teklu, Steve Younger, two anonymous referees and participants at the 2000 Northeast Universities Development Conference for helpful comments and discussions. Any remaining errors are theirs alone.

The Journal of Development Studies, Vol.39, No.5, June 2003, pp.152–180
PUBLISHED BY FRANK CASS, LONDON

INTRODUCTION

The problem of targeting transfers is a key issue among scholars and development professionals concerned about poverty, food insecurity, and vulnerability. Given a fixed amount of resources available to transfer to a population, what method of screening prospective recipients does one employ so as to generate the greatest aggregate reduction in income poverty, malnutrition, or another indicator of choice?[1]

In low-income settings, administrative targeting requiring documentation of individuals' assets and incomes is typically infeasible, although it can be a relatively accurate means of identifying the poor in higher income settings [*Besley and Kanbur, 1988; Barrett, 2002*]. So-called 'indicator' targeting is frequently used instead, distributing to sub-populations readily identifiable by age, gender, or location because in aggregate those cohorts are worse off than other broad, identifiable groups. Like targeting based on administrative screening of applicants' asset and income status, this method restricts participation administratively, but the indicators used make enacting the restriction (for example, to feed only children below a certain age at a center, to deliver food just to a region that has suffered severe drought) relatively simple. A major concern, however, is that indicator targeting often entails substantial leakage to the non-needy within the targeted sub-population, thereby weakening the safety net and pitting the transfer system against the commercial production and distribution system that otherwise serves consumers of sufficient means.

The most popular method now is 'self-targeting' transfers that have no administrative restrictions on participation, but the nature of which is supposed to induce only those within a target beneficiary group to self-select into participating. In principle, there is no need for costly administrative screening nor for significant leakage to the non-needy. The characteristics of the transfer should suffice to create incentives for participation that vary across individuals. Common self-targeting features of transfers include the (low) quality of a subsidised foodstuff, queuing to receive transfers, or a work requirement that carries a high opportunity cost of time for the relatively better-off. The cost (benefit) of participation is made an increasing (decreasing) function of one's pre-participation income or wealth, so that only the needy find project participation attractive. Self-targeting methods have been used by governments for a long time [*Drèze and Sen, 1990*] but have become especially prominent in the past decade. The government of Ethiopia, for example, now devotes 80 per cent of its food assistance resources to food-for-work (FFW) programmes based on the principle of self-targeting [*FDRE, 1996*].

Food-for-work is the most common type of self-targeting transfer in low-income rural settings.[2] The idea is to offer unlimited employment, but

at a wage low enough that only the truly destitute are willing to particip
The Employment Guarantee Scheme in Maharashtra state, India, is perh
the most well-known example of a self-targeting employment program
[*Herring and Edwards, 1983; Ravallion, 1991; Ravallion et al., 19*
FFW has become increasingly popular in Sub-Saharan Africa over the p
decade [*Devereux, 1999; von Braun et al., 1999*].

FFW programmes are increasingly promoted as an effective means
provide food assistance to needy households in low-income rural econom
while simultaneously achieving development objectives [*Clay, 19*
Ravallion, 1991; von Braun, 1995; Barrett et al., 2002]. Most FFW proje
employ able-bodied individuals at a below-market wage rate, often but
always paid in grain, flour, oil, or other foodstuffs, typically in public wo
projects such as road construction or rehabilitation. There are ma
potentially appealing features of FFW programmes, of which the m
commonly cited is its self-targeting character.

But the efficacy of FFW projects in reaching the needy has come un
scrutiny of late. While much of the empirical evidence supports the cla
that FFW – and self-targeting employment schemes more broadly
effectively reaches intended beneficiaries [*Ravallion, 1991; von Bra*
1995], several recent studies have found evidence that many nonpo
participate in FFW schemes, calling into question the efficacy of the se
targeting feature [*Clay et al., 1999; Devereux, 1999, Jayne et al., 20*
Teklu and Asefa, 1999; Gebremedhin and Swinton, 2000]. The m
common explanation is that the FFW wages were set too high, induci
substitution of money wage work in the local labour market for FFW wo
and thereby limiting the additionality of the FFW transfer since it large
substitutes for other income that would have been earned in the projec
absence [*Ravallion et al., 1993; von Braun, 1995; Teklu and Asefa, 19*
Jalan and Ravallion, 2000]. Moreover, when wages are set too high, proj
managers commonly face excess labour supply and have to rati
participation in some fashion. There are good reasons to believe local elit
enjoy a higher probability of selection for participation than do outcasts.[3]
addition to there commonly being unintended beneficiaries, many intend
recipients get missed by FFW programmes. In some cases this is becau
they get crowded out by participating elites. Other times finite transf
resources limit the geographic reach of the programe to a fe
administratively selected locations [*Devereux, 1999; Gebremedhin a*
Swinton, 2000]. The common feature of these explanations of the targeti
deficiencies of FFW is the suggestion that targeting errors can be correct
by a change in operational methods: a lower FFW wage, closer auditing
employment roles, a larger budget to expand geographic coverage and
on. We accept these important points.

In this article we argue, however, that in addition to explanations resting upon such operational details, the accuracy of the self-targeting component of food-for-work schemes may be fundamentally limited by structural weaknesses affecting the nature of local labour supply in low-income agrarian settings. Factor markets in land, labour and capital are often incomplete in poor, rural economies, so labour and cultivable land do not necessarily move freely between households so as to equalise (quality-adjusted) land/labour ratios. Therefore household willingness to participate in a FFW project need not be strongly, inversely related to household pre-transfer income *on an unconditional basis*, as the theory of self-targeting assumes. Put differently, even if managers get all the operational details right, FFW projects may still experience considerable leakage to the relatively better-off and may still miss many of the poorest due to factor market failures. A household's reservation FFW wage may indeed increase in income, but only conditional on other structural factors – in particular, the composition of households' productive asset endowments – that influence shadow wages and nonwage factors affecting willingness to participate in the FFW scheme. Put differently, the very structural weaknesses that motivate transfers to the poor may impede the effective self-targeting of transfers meant to relieve their poverty.

The remainder of the article proceeds as follows. First, we situate the work in its empirical context, Ethiopia in the latter part of the 1990s, describe the unique data set we use, and document the targeting errors observable in household data on FFW participation in Ethiopia. We then offer a simple model of household willingness to participate in a food-for-work scheme, emphasising the role of endogenous shadow wage formation in households facing factor markets characterised by frictions that induce households to self-select out of particular markets and that render household and hired labour imperfectly substitutable. We then estimate the structural model using the Ethiopian data, taking care to control for censoring and unobserved heterogeneity issues. A brief concluding section draws out the implications of this work.

FOOD AID AND FOOD-FOR-WORK IN ETHIOPIA

Ethiopia is a large nation of more than 60 million people in the Greater Horn of Africa. Annual per capita income is among the lowest in the world and the nation is among the largest food aid recipients in the world, historically and currently. The 1984-85 drought was extensively profiled in the western media, and elicited unprecedented humanitarian response. According to data from the World Food Programme, Ethiopia lagged only Bangladesh in volume of food aid received, 1994–98, the most recent five year period for

The dependent variable that makes this study unique is the household's reservation FFW wage, which was elicited in the following manner. Each household was asked 'If a food-for-work programme were implemented in this area next month to plant trees or build roads, would you (or another adult from this household) work a six hour day, five days each week for a month, in return for' a daily wage of a particular quantity and form of grain or of cash.[6] In the case of in kind payments, the enumerators' instructions were to start with the response four kilograms, which is on the high end of prevailing FFW wage rates in Ethiopia at the time. If the respondent answered 'no', the enumerator increased the amount of grain by one kilogram until the respondent's answer switched to 'yes', at which point that minimum acceptable wage was recorded. The enumerators stopped at ten kilograms, so the data are censored from above. If the respondent initially answered 'yes' to four kilograms, the enumerator decreased the amount of grain by one kilogram until the respondent's answer changed to 'no', and the lowest 'yes' response was recorded as the minimum acceptable wage. The enumerators stopped at one kilogram, so there may be some (very modest) censoring from below as well. All respondents were asked this for three different grain types – white wheat, red wheat and maize – so as to control for ethnic and regional differences in preferences. They were also asked their willingness to participate for cash wages where the same procedure was followed, starting at eight birr (worth just over US$1 at the time) and increasing by one birr to a ceiling of 18, or decreasing by one birr.

So the reservation wage elicitation process was in the spirit of the iterative bidding process common to many contingent valuation studies in environmental economics [*Arrow et al., 1993*]. The particular starting point chosen might matter to the establishment of the precise level of the labour supply curve due to anchoring effects, but since all households were presented with the same offer process, this should have no effect on the estimated slope of the FFW labour supply curve nor on the correlates of willingness to participate in a FFW programme at any given offered wage rate.

While food aid and FFW programmes are commonplace throughout Ethiopia, not everyone is familiar enough with either the programme or particular commodities to offer a well-informed answer. No effort was made to push respondents for answers to these questions if they felt uncomfortable. So between 13.8 and 19.5 per cent of the full sample depending on the particular commodity form chosen, did not reply (or replied 'I don't know') to the elicitation question. We have checked these missing values and find no statistically significant difference in income household assets or composition, or region, so there is no evidence that the missing observations create any sort of bias.[7]

These data offer a novel opportunity to explore households' willingness to participate in FFW programmes in the nation with the largest food aid distribution and FFW programmes in Africa. Other studies have relied solely on realisations of households' participation decisions by studying observed behaviour. The findings of such studies [e.g., *Ravallion, 1991; von Braun, 1995; Teklu and Asefa, 1999*] tend to support the claim that FFW effectively self-targets poor households. We are concerned, however, that previous studies either (a) draw on data from areas where large landless sub-populations and reasonably well-developed rural labour and land markets (for example, India, where the Maharashtra Employment Guarantee Scheme has been extensively studied) dampen our concerns about the effects of rural factor market failures, or (b) fail to control adequately for either alternative (self-)employment opportunities faced by prospective participants or for the self-selection mechanism itself. Direct elicitation of reservation FFW participation wages in Ethiopia provide a unique opportunity to explore the determinants of self-selection into a self-targeting transfer programme amid incomplete rural factor markets.

Figure 1 displays the estimated national labour supply curve for a FFW programme with payments in white wheat (measured against the lefthand Y-axis).[8] It slopes upwards, as one would expect, with highly elastic labour supply at very low wages and modestly inelastic labour supply at higher wages (of eight or nine kilograms per day).[9] Figure 1 also shows labour supply based on cash reservation FFW wages converted to white wheat equivalents using local (zone-level) producer and retail prices for net food sellers and net food buyers, respectively, so as to capture households' marginal value of the wheat.

In theory, the upward slope in the aggregate labour supply curve reflects differing opportunity costs of labour supply that are strongly and positively correlated with household income. There are two sources to this supposed effect. First, individuals endowed with greater skills or human capital are more productive and therefore earn a higher wage, making them less willing to forego private employment for FFW participation. Because they earn a higher wage, they are also less likely to be poor and in need of the support. So by making the opportunity cost of time higher for richer households, the theory holds that FFW effectively self-targets poor households when wages are set low enough.

Second, if leisure is a normal good, especially if it is a luxury good (that is, characterised by an income elasticity of demand in excess of one), then higher income households will want to consume more leisure than lower income households and so will be less willing, *ceteris paribus*, to participate in a FFW programme with a significant minimum hours requirement, as is true of most programmes in practice and of the question posed to the respondents in the survey we use.

FIGURE 1

ESTIMATED AGGREGATE FFW LABOR SUPPLY AND FUNGIBILITY PREMIUM

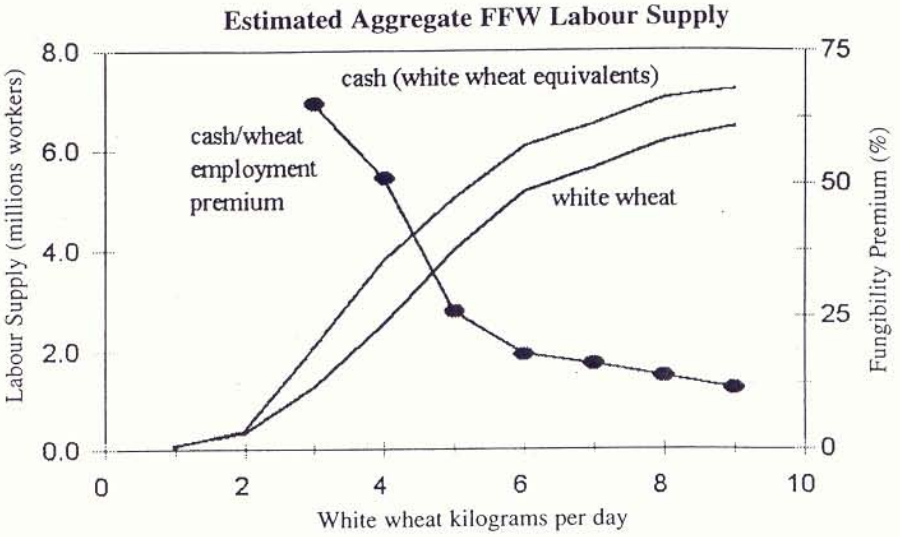


TABLE 1

1995–96 ANNUAL HOUSEHOLD INCOME PER ADULT EQUIVALENT CONDITIONAL ON RESERVATION FFW WAGE (ETHIOPIAN BIRR)

Kilograms	White wheat Mean (Std Dev)	Red wheat Mean (Std Dev)	Maize Mean (Std Dev)	Cash* Mean (Std Dev)
2	608	615	636	590
	(533)	(546)	(513)	(699)
3	774	695	663	775
	(745)	(666)	(632)	(781)
4	737	761	669	849
	(816)	(710)	(612)	(811)
5	830	768	813	854
	(710)	(783)	(769)	(808)
6	798	820	721	791
	(710)	(735)	(656)	(764)
7	940	789	786	834
	(1035)	(694)	(832)	(975)
8	1024	919	874	1174
	(1000)	(932)	(750)	(953)
9	952	1032	818	1030
	(741)	(1001)	(902)	(963)

* Expressed in kilograms of white wheat, converted using local retail prices for net buyer households and producer prices for net seller households.

Note: Only uncensored reservation wage rates (2–9 kilograms, or 2–17 birr) are included.

Table 1 shows that the hypothesis of a strong, positive relationship between a household's income and its reservation wage rate finds little support in the Ethiopian data. While mean household income is indeed (non-monotonically) increasing across the reservation wage levels, the increase is statistically insignificant at any reasonable confidence level. Large standard deviations in household income per adult equivalent at each reservation wage level indicate considerable income heterogeneity among households willing to participate at any given wage rate. The opportunity cost of time appears only quite weakly related to household income per capita on an unconditional basis. So the wage rate does a relatively poor job of inducing disproportionate participation by the poor even in FFW programmes offering relatively low wages.

Targeting questions also arise obliquely in the interesting pattern that appears when one compares the estimated aggregate labour supply curves for payment in cash and kind. Above two kilograms, up to which point labour supply is negligible, labour supply is everywhere greater when payment is in cash rather than in kind, revealing a nontrivial fungibility premium prospective FFW participants place on the form in which the transfer is received. We estimate the fungibility premium as the per cent additional employment the sponsoring agency could attract using cash instead of wheat to pay a given wage rate. One can clearly employ more households for a given budget if compensation is made in cash rather than in kind. The fungibility premium (depicted by the line marked with ovals and plotted against the righthand Y-axis) decreases in the wage rate, from 65 per cent at a low of three kilograms of white wheat, down to 12 per cent at high end of the wage range considered.[10] This observation reinforces Drèze and Sen's [*1990*] point that the justification for transfers in kind turns on the need to resolve a local supply problem for the foodstuff in question since the transfers become more expensive per recipient to achieve the same desired end of support.

It is important to consider why such a cash premium might exist. As has been understood at least since Southworth [*1945*], if recipients are net food buyers and the transfer is infra-marginal (that is, the recipient still buys food post transfer), then the form of the transfer should not matter.[11] The most likely explanation for the observed premium is that the transfer is not infra-marginal for some beneficiaries at any given wage rate. This would be the case if recipient households are net grain sellers. Since there is typically a strong positive correlation between household marketable food surplus, land holdings and income in rural Africa [*Barrett and Dorosh, 1996*], the observation of a substantial cash premium again suggests mistargeting.[12]

An ideally targeted programme would have neither errors of exclusion – members of the target sub-population who self-select out of the programme

– nor errors of inclusion – individuals not in the target sub-population who self-select into the programme. Assuming the target sub-population consists of those below a certain threshold income level, ideal targeting would generate a participation probability function that is piecewise linear, like the stylised one depicted in Figure 2, with a horizontal line at value one (that is, 100 per cent frequency of participation) until the threshold income level, at which point the curve falls straight to a horizontal line at value zero (that is, 0 per cent frequency of participation beyond the threshold identifying the target sub-population). While no actual transfer scheme attains this unrealistic ideal standard, the extent of deviations from this benchmark are informative none the less.

Moreover, if one conjectures that targeting errors in FFW programmes are attributable to incorrectly set wage rates, then one should be able to use such participation probability function estimates to see if wage rate variation indeed affects targeting. For wage rate reduction to be successful in improving the targeting of the FFW transfer, then as the wage rate falls the participation probability function must pivot downward from the upper boundary at the targeting threshold point, steepening its (negative) slope so as to reduce errors of inclusion, while maintaining its intercept, so as to preclude increased errors of omission. By contrast, if a lower FFW wage induces parallel downward shifts of the participation probability function, then programme changes merely trade reduced errors of inclusion (lower probability of participation on the high end of the income distribution) for increased errors of exclusion (lower probability of participation on the low end).

FIGURE 2

STYLISED PARTICIPATION PROFILE UNDER PERFECT SELF-TARGETING

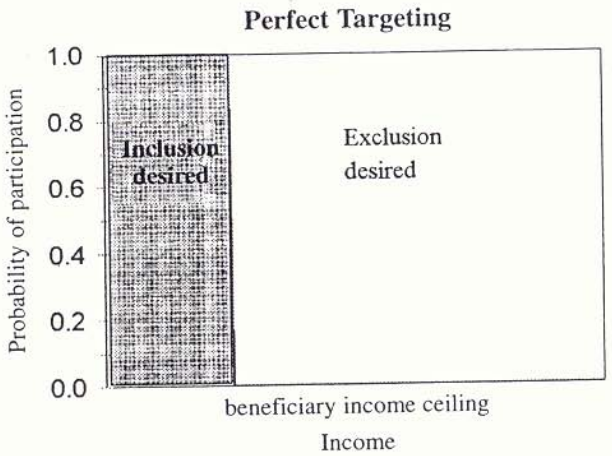


Figure 3 presents non-parametric nearest-neighbor regressions of a willingness to participate indicator variable[13] on household income per adult equivalent for three different wage rates: three, six and nine kilograms of white wheat.[14] The desirable pivoting effect is indeed evident as one moves from an above-market wage rate of nine kilograms down to six (the median and mean reservation FFW wage were between five and six kilograms in these data). So wage rate determination clearly matters to FFW project participation profiles, as the existing literature emphasises. Pushing FFW wage rates lower still, however, appears to backfire, leading mainly to a sharp increase in errors of exclusion. So the oft-heard claim that one can improve targeting in FFW programmes merely by lowering real wages seems only weakly supported in these data.

Moreover, even though participation by the relatively well-off responds in the desired direction to wage adjustments, errors of inclusion remain rather large. Median annual income per adult equivalent is 885 birr in this sample, just over US$100, and the participation probability of a household with income equal to twice the sample median is always at least 80 per cent of the participation probability of a household in the lowest decile. Even in a self-targeting programme like FFW, leakage to unintended beneficiaries appears considerable.

Furthermore, errors of exclusion among the poorest become very high, especially as one approaches the mean reservation FFW wage. At a FFW wage of six kilograms of wheat, one would expect almost one-third of the poorest quintile to choose not to participate in the FFW programme. And at a wage of five kilograms (not shown), the fraction of the lowest income quintile self-selecting out of the FFW programme increases to roughly one-half. Many of Ethiopia's able-bodied poor appear to have better uses for their time than participation in low-wage FFW programmes.

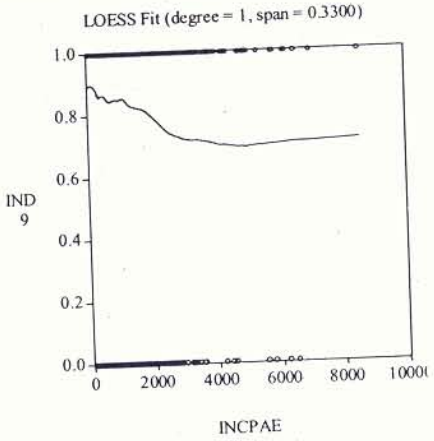
The question remains: why such errors in an ostensibly self-targeting transfer? The next section offers a simple explanation of why even operationally ideal FFW programmes (that is, those free of corruption and offering below-market wages) may suffer significant targeting errors in the presence of imperfect rural factor markets. The subsequent section successfully tests the predictions of that model before we turn to discussing the implication for designing effective transfer schemes in low-income rural areas suffering incomplete markets.

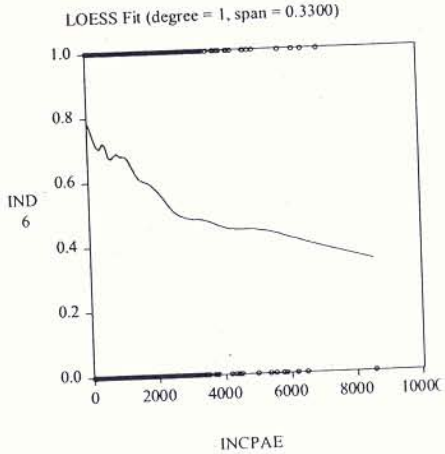
A MODEL OF HOUSEHOLD WILLINGNESS TO PARTICIPATE IN A FFW PROGRAMME

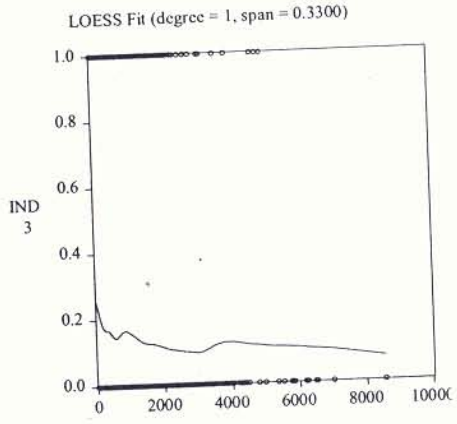
The relationship between labour supply and transfers has received recent attention in the context of potential work disincentive associated with

FIGURE 3

NEAREST NEIGHBOUR (LOESS) REGRESSIONS OF WILLINGNESS TO PARTICIPATE IN FFW ON HOUSEHOLD INCOME PER ADULT EQUIVALENT, AT DAILY PAYMENT RATES OF 9, 6, AND 3 KILOGRAMS OF WHITE WHEAT, RESPECTIVELY







transfers [*Moffitt, 1992; Kanbur et al., 1994; Sahn and Alderman, 1996*]. The published research relating labour supply decisions to household willingness to participate in FFW projects or related transfer schemes is very limited, however, and the only other paper of which we are aware [*Jalan and Ravallion, 2000*] is not focused on targeting issues so much as it is on estimating the income gains enjoyed by programme participants. This section develops a simple model, which we then estimate from the Ethiopian data.

The reservation wage at which a household becomes willing to participate in a FFW programme depends on the opportunity cost of both the labour committed to the programme and whatever disutility acceptance of public assistance might impose on the household, perhaps due to stigma or self-esteem effects.[15] So one can specify the reservation FFW wage as

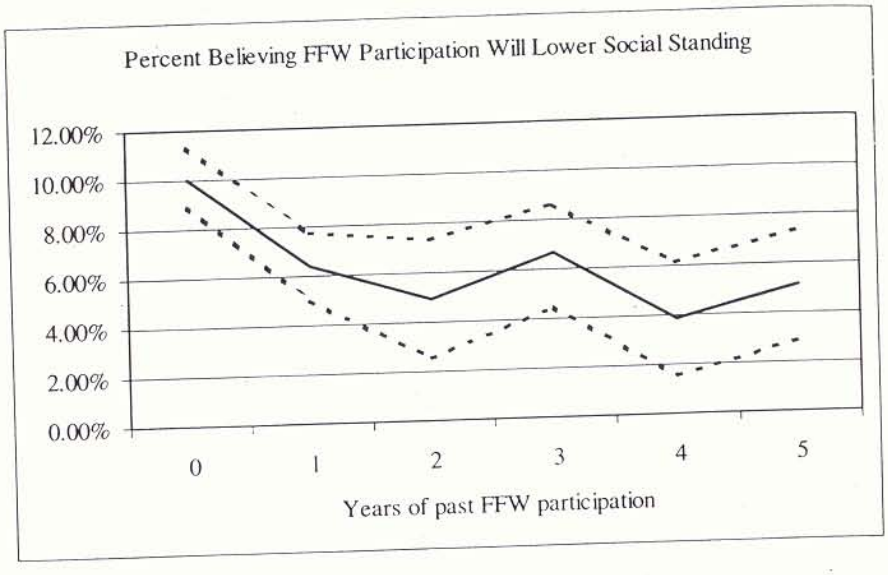
$$w_{ij}^{FFW} = w_{ij}^{*} + \rho\,(h_{ij}^{FFW}, x_{ij}, y_{ij}) \qquad (1)$$

where w_{ij}^{FFW} is the wage at which the i^{th} household in the j^{th} community is willing to participate in the FFW programme, w^* is the shadow wage the household could receive for its labour applied elsewhere, and ρ is a premium the household might demand due to the potential stigma or differential transactions costs (for example, queuing, or distance to project site) associated with FFW participation, or to poor information about the FFW project and associated work demands. If stigma or self-esteem or information effects are greatest on initial receipt of assistance, then this premium should be a decreasing function of the household's FFW participation history, h^{FFW}, expressed in terms of years of past participation. Indeed, the Ethiopia survey included a question designed to elicit households' perception of the stigma effect associated with FFW participation. This variable shows that the probability that a household believes FFW participation will lower its social standing decreases significantly when one moves from no past participation to having previously participated (Figure 4). Interestingly, however, this admittedly crude measure of stigma effects is statistically unchanging with respect to years of participation among past participants. The disutility associated with stigma is likely increasing in income, y – that is, reputation and self-esteem are normal goods – and elements of the household characteristics vector, x (for example, gender), likely also affect the production of disutility due to stigma or self-esteem.

While the potential disutility effects of participation in a public assistance scheme must be taken into account in trying to explain households' declared reservation FFW wages, the opportunity cost of time is likely the main determinant of a household's willingness to participate. So we emphasise primarily the determination of the household shadow wage,

FIGURE 4

FFW STIGMA EFFECTS WITH BOOTSTRAPPED 95% CONFIDENCE BANDS



w*, reflecting the opportunity cost of the household's time prospectively spent in a FFW programme. The theory behind the self-targeting feature of FFW is that households with substantial endowments of productive assets (for example, land, livestock) enjoy relatively high marginal returns to labour from self-employment and so have higher shadow wages than their less wealthy, lower-income neighbours. Similarly, relatively healthy and well-educated persons may exhibit higher labour productivity due to superior human capital endowments, so the market wage they earn should be higher than that received by less healthy or well-educated persons. So if one wants to make an unrestricted offer of employment but have only the poor – in human and physical capital terms – take up that offer, setting a low wage rate should effectively induce self-selection into the programme by the poor and out of the programme by the wealthy.

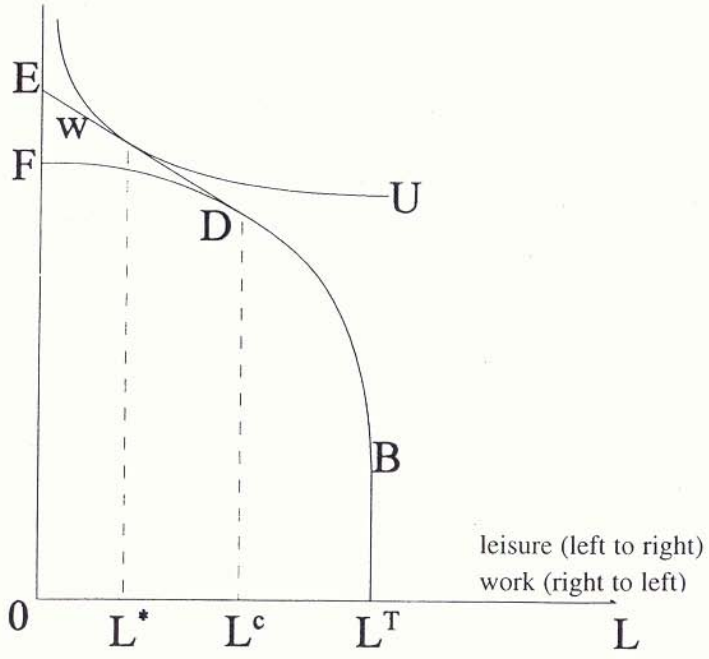
The problem with this reasoning is that where many households self-select out of markets in labour, land, livestock, and other factors of production, factor endowment ratios are not necessarily equalised through markets. In such a setting, it is not the absolute level of a household's wealth or income that determines its shadow wage, but rather the composition of its wealth, the ratios relating household's endowment of labour, land, livestock and so on. A poor household may have relatively little land, but if it has proportionately even less labour and does not hire in labour for whatever reason,[16] then that household's shadow wage in self-employment on-farm may none the less exceed the shadow wage of a wealthier

household possessing more land but also proportionately greater labour. Frictions in factor markets that inhibit households' ability to equalise factor ratios across production units, may thereby result in considerable variability in marginal rates of labour productivity, that is, in shadow wages.[17]

The basic structural model of shadow wage determination can be depicted in simple graphics.[18] Assume an agricultural household endowed with a fixed stock of land and employing a production technology that is strictly concave in variable inputs. Figure 5 depicts that household's budget constraint, a non-linear combination of exogenous income (the line segment from L^T to B), own farm production (the arc from B to F), and wage income (the line segment from to D to E, having slope equal to the real wage rate). Diminishing marginal productivity of labour in own production implies the shadow wage falls as the household spends more labour on farm work. The household maximises its welfare by choosing a labour allocation pattern like that at L^*, where it utility curve is tangent to its budget set. A concave production function implies that there is some point of work effort (leisure consumption), L^c, above (below) which the marginal revenue product of labour allocated to own production falls below the prevailing market real wage rate (graphically, the tangent line to the own farm production set has flatter slope than the wage/price line). In that portion of work-consumption space, households self-select into the market and the prevailing market

FIGURE 5

HOUSEHOLD LABOUR SUPPLY DECISIONS AND SHADOW WAGE DETERMINATION



wage is their shadow wage. The rationality of labour market participation in this range is obvious when one recognises that labour market participation then expands the household's budget set (L^TBDE versus L^TBDF). At lower (higher) levels of work effort (leisure), the optimal allocation is to devote all available labour to own production and not to participate in the wage labour market, yielding a marginal revenue product of labour that may well exceed the market wage rate.

The expectation that FFW will induce self-selection into the programme by poorer, intended beneficiaries rests on an implicit assumption that households operate on the linear portion of this budget set. If wealthier households have more skilled labour and thereby enjoy higher wage rates, w^H, than the unskilled rate earned by poor households, w^U, then selection of a FFW wage rate, $\tilde{w}$, somewhere between the two, $w^U < \tilde{w} < w^H$, will effectively expand the poorer households' budget set and induce its participation in the FFW programme, without expanding the wealthier households' budget set or inducing their participation.

However, many rural households in low-income economies do not participate in wage labour markets.[19] Since the budget constraint is nonlinear, there is no unique shadow wage rate that obtains across all levels of input/output allocation, nor is there a unique level of full income available for expenditure on consumption of goods and leisure. So one must linearise the budget constraint locally at the household's optimum to employ traditional demand (labour supply) estimation techniques. This linearisation yields an endogenous shadow wage (w^*) that is a function of household preferences, shadow income, endowments of other productive assets (including human capital that effects the wage rate one can earn in the labour market), and prevailing prices for farm output. This permits recovery of an inverse labour supply function for household i in location j:

$$w_{ij}^* = w^*(y_{ij}^*, x_{ij}, p_j) \qquad (2)$$

where y^* is shadow income, x is a vector of household characteristics including both productive inputs to farming (land, livestock, rainfall, land improvements, non-labour variable inputs), and human capital characteristics (gender, age, education) that affect labour productivity and wages, while p is a vector of local market prices. Market prices are presumed to be uniform for all households in a given region while the other variables vary across individual households even with regions.

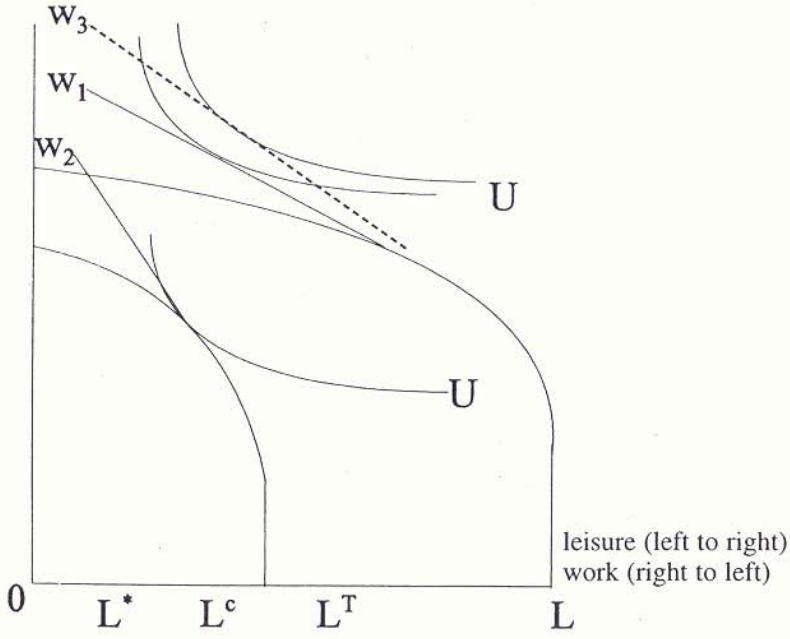
An important implication of this structural approach to the determination of household-specific shadow wages is that there will likewise be a household-specific reservation FFW wage that is the minimum compensation necessary to induce participation in the programme. Figure 6 offers a stylised depiction of the reservation FFW

wages for three different households. The first two households, 1 and 2, differ only by their labour endowment (that is, the land/labour ratio in their productive asset endowment). Household 1 has more labour available, so it enjoys higher income, as reflected by its larger budget set. But the marginal productivity of the better endowed household's labour is none the less lower than that of the lesser endowed household, 2, for any given level of leisure consumption as reflected in the shallower slope of household's tangent shadow reservation wage line, w_1, as compared to w_2. Households 1 and 3 differ only by the marketability of their labour. Household 3 has the same endowments, save that some of its labour is more valuable, perhaps due to educational attainment that has no effect on agricultural labour productivity (else the curvilinear portion of the budget set would differ too) but commands a premium in the wage labour market. So household 3 can earn a private wage rate, w_3, in excess of household 1, driving up its reservation FFW wage. The theory of self-targeting is that a FFW wage rate between w_3^{FFW} and w_1^{FFW} will induce participation by the poorer household 1, but not by the wealthier household 3.

But as this stylised example demonstrates, it is actually the poorest household 2 that would be the last among these three to participate, because the marginal value of its scarce time is greatest. The key point is that is not so much households' absolute endowments – that is, their wealth – as their

FIGURE 6

RESERVATION FFW WAGES FOR DIFFERENT STYLISED HOUSEHOLDS



relative endowments – especially the ratio of labour to non-labour productive inputs – that drives shadow wage determination when households do not face a parametric wage rate due to local market frictions that impede participation and substitutability. We hypothesise that imperfect markets in rural Ethiopia can explain much of the errors of exclusion and inclusion observed in the data because factor market failures constrain households' ability to trade assets and services, thereby rendering shadow wages endogenous and breaking down the unconditionally positive relation between income and shadow wage that underpins the theory of self-targeting public employment programmes.

We can combine the results to this point to yield an estimable reduced form expression for the reservation FFW wage of household i in region j as a function of income, productive assets, human capital, and prices:

$$w_{ij}^{FFW} = f(h_{ij}^{FFW}, x_{ij}, y_{ij}^{*}, p_j) = f(z_{ij}) \quad (3)$$

where $z_{ij} = (h_{ij}^{FFW}, x_{ij}, y_{ij}^{*}, p_j)$. The next section estimates this relation econometrically using the Ethiopian data.

RESERVATION FFW WAGE DETERMINATION IN ETHIOPIA

The preceding model emphasises the centrality of households' relative productive asset endowment to their endogenous shadow wages and therefore their reservation wage rates for FFW participation. This effect would not exist if all households faced a common market wage rate that guided their labour allocation choices. The test for a non-zero relation between a household's reservation wage rate and its productive asset holdings, controlling for income and potential stigma and information effects, is thus a test for factor market imperfections since the asset's effect on the reservation wage rate must therefore be related to labour's marginal productivity but not to income.

If productive asset holdings are correlated with per capita income in such a way that higher incomes are typically associated with higher ratios of labour to nonlabour productive assets, then factor market failures could well explain what appears to be a weak unconditional relationship between per capita income and FFW reservation wages. Indeed, in the Ethiopian data, household labour supply is strongly positively correlated with income. A history of land reform and underdeveloped rural asset markets combine with the positive relationship between income and household size in Ethiopia to generate correlation coefficients relating per capita income to land and livestock holdings per capita that equal -0.299 and -0.288, respectively, both of which have a p-value of zero against the null hypothesis of zero correlation.[20] The inaccuracy of FFW work targeting

stems directly from the basic facts that (i) in rural Ethiopia, higher income households are endowed with more labour per unit of land or animal, and (ii) factor markets in land and livestock do not appear to function well. These two phenomena break the unconditional link between income and reservation FFW wage rates on which the theory of self-targeting depends by reducing the productivity of higher income household labour at the margin, *ceteris paribus*.

A further factor that might contribute to poor households' greater than expected reluctance to participate in FFW projects might be the lumpiness of the labour requirement. Household size is positively correlated with per capita income in rural Ethiopia (r=0.286).[21] The common FFW project requirement of 40 hours per week of labour therefore represents a larger share of the labour endowment of smaller, poorer households, on average, than it does of larger, wealthier ones. Unequal capacity to bear the minimum required contribution likely also inhibits participation by poorer households.

With these raw correlations in mind, we now estimate household reservation FFW wage rates, the minimum wage rate a household declared acceptable for it to contribute a member to work on the project. First, however, we must attend to two crucial features of the data that demand careful econometric treatment. Recall that respondents' declared reservation FFW wages were bounded from above by the value ten kilograms and from below by one kilogram for in kind payments, we estimate the reservation FFW wage using doubly-censored reservation wage models. The basic estimation strategy follows a generalised Tobit approach, regressing the latent variable $\tilde{w}$, on a linear approximation of the general reduced form expression in (3):

$$\begin{aligned} \tilde{w}^{FFW}_{ij} &= \beta' \mathbf{z}_{ij} + \varepsilon_{ij} \\ w^{FFW}_{ij} &= 1 \text{ if } \tilde{w}^{FFW}_{ij} \leq 1 \\ w^{FFW}_{ij} &= \tilde{w}^{FFW}_{ij} \text{ if } 1 < \tilde{w}^{FFW}_{ij} < 10 \\ w^{FFW}_{ij} &= 10 \text{ if } \tilde{w}^{FFW}_{ij} \geq 10 \end{aligned} \tag{4}$$

with the residuals, ε_{ij}, assumed iid normal with mean zero.[22]

The second econometric obstacle we must hurdle arises from the absence of data on market wage rates, prices, local histories with projects and so on. Under the assumption that these missing relevant variables share a common value for all households within each of the 53 *killil* zones, we can use a fixed effects estimator to control for those unobserved factors that can be reasonably taken to vary only between communities but not between households within a given community. Letting $\hat{w}^{FFW}_{ij} = w^{FFW}_{ij} - \bar{w}^{FFW}_{j}$ and $\hat{z}_{ij} = z_{ij} - \bar{z}_{j}$, where $\bar{w}^{FFW}_{j}$ and $\bar{z}_{j}$ represent the community means of their respective variables, the doubly-censored model of equation (4) can be rewritten as

$$\begin{aligned} \hat{w}^{FFW}_{ij} &= \theta' \hat{z}_{ij} + \upsilon_{ij} \\ w^{FFW}_{ij} &= c^{L}_{j} \text{ if } \hat{w}^{FFW}_{ij} \leq c^{L}_{j} \\ w^{FFW}_{ij} &= \hat{w}^{FFW}_{ij} \text{ if } c^{L}_{j} < \tilde{w}^{FFW}_{ij} < c^{U}_{j} \\ w^{FFW}_{ij} &= c^{U}_{j} \text{ if } \hat{w}^{FFW}_{ij} \geq c^{U}_{j} \end{aligned} \tag{5}$$

where the lower and upper censoring limits, $c^{L}_{j} \equiv 1 - \bar{w}^{FFW}_{j}$ and $c^{U}_{j} \equiv 10 - \bar{w}^{FFW}_{j}$, respectively, now vary across communities. Because this doubly-censored fixed effects estimator controls for all omitted community-level covariates and because the household-level variables implied by the structural model developed in the previous section are available to us, the latent variable specification in (5) yields consistent estimates of the θ parameters of interest.[23]

Our regression results, presented in Table 2, exhibit several clear patterns consistent with the structural model of the preceding section. These hold across all four payment forms: cash, maize, red wheat, and white wheat. First, the FFW reservation wage is indeed increasing in income, *ceteris paribus*, thereby confirming consumer preference for leisure as a normal good. Second, the reservation wage rate is also increasing in productive non-labour asset endowments, land, livestock, and rainfall. More of any of these increases the on-farm productivity of a fixed stock of labour, thereby increasing the minimum wage a household will accept to part with some of its fixed stock of labour. But holding non-labour endowments constant, more people in a household decreases marginal labour productivity, thereby depressing the reservation wage rate acceptable for participation in a FFW scheme. Ethiopian agricultural households do not behave as if they face a complete set of rural factor markets offering labour, land, and livestock at fixed parametric prices. Rather, factor pricing appears to have a significant household-specific component to it, leading to heterogeneity of FFW reservation wages that depends on more than just income and consumer preferences for leisure as a normal good.

As conventional labour economics theory predicts, human capital variables matter to labour market participation, FFW included. Educational attainment appears to exert a positive effect on the valuation of one's time. Households headed by individuals who have completed primary schooling require higher wage rates to participate in FFW schemes than do the default households headed by illiterates or those headed by literate persons who have not completed primary school. Women exhibit consistently higher reservation FFW wages than men do, with the differences statistically significant at the one per cent level for each payment form other than maize. Women are likely more reluctant to participate in FFW programmes because their domestic responsibilities above and beyond income-earning activities on- or off-farm are typically much greater than men's, thereby

increasing the opportunity cost of women's time in spite of widespread market wage disparities that favour men. Where women can commonly integrate some of those domestic tasks (for example, child care) into work on their own-farm, such integration is often harder or impossible away from home in a FFW project.

The statistically significant correlates of FFW reservation wages are not solely those that determine the household's opportunity cost of time spent in FFW. The household's FFW reservation wage is significantly lower if it believes FFW participation would lower its social standing, thereby providing a direct indication of the stigma or self-esteem effects associated with programme participation. A household's history of FFW participation

TABLE 2

FIXED EFFECTS, DOUBLY-CENSORED REGRESSION ESTIMATES OF FFW RESERVATION WAGE FUNCTIONS, BY FORM OF PAYMENT

	Form of FFW Payment			
	Cash (birr)	Maize (kgs)	Red Wheat (kgs)	White Wheat (kgs)
Income	0.00015*	0.00011*	0.00009*	0.00009†
	(0.00004)	(0.00002)	(0.00003)	(0.00003)
Labor	–0.093†	–0.047	–0.063	–0.080†
	(0.041)	(0.051)	(0.037)	(0.036)
Land	0.080†	0.057	0.082*	0.117*
	(0.026)	(0.042)	(0.021)	(0.030)
Livestock	0.131*	0.086*	0.142*	0.141*
	(0.032)	(0.035)	(0.023)	(0.021)
Avg. Rainfall	0.0008†	0.0005	0.0003	0.0003
	(0.0002)	(0.0003)	(0.0003)	(0.0003)
Lower Social Standing	–0.102*	–0.273*	–0.208*	–0.189*
	(0.029)	(0.092)	(0.036)	(0.055)
Yrs. FFW	–0.068*	–0.210*	–0.197*	–0.108*
	(0.028)	(0.077)	(0.047)	(0.009)
Yrs. Free Food Aid	–0.027	–0.069	–0.042	–0.026
	(0.182)	(0.052)	(0.051)	(0.019)
Literate w/o Primary Schooling	0.439†	0.109	0.240	0.272
	(0.201)	(0.214)	(0.183)	(0.156)
Primary Schooling Completed	0.650*	0.491†	0.591*	0.431*
	(0.189)	(0.200)	(0.145)	(0.128)
Age of HH head	–0.007	–0.004	–0.007†	–0.006
	(0.004)	(0.005)	(0.004)	(0.004)
Female HH head	0.522*	0.117	0.455*	1.127*
	(0.174)	(0.185)	(0.137)	(0.153)
# observations	2796	2611	2677	2726
% censored obs.	3.3	34.9	16.3	13.4

Note: Standard errors in parentheses. * indicates statistical significance at the 1 per cent level, † indicates statistical significance at the 5 per cent level.

seems to have a strong effect independent of its belief with respect to social standing. More experience with FFW participation reduces the reservation FFW wage, presumably due to informational effects associated with past participants' greater familiarity with the responsibilities entailed. This interpretation is reinforced by the fact that a household's history of receipt of free food aid (for which individuals do not have to work) has no significant effect on the FFW reservation wage rate. The strength and consistency of these effects would appear to signal that there is indeed a premium attached to the marginal value product of labour, whether it is due to stigma or self-esteem effects that are decreasing at the margin as one accumulates a history of FFW participation, increasing comfort with participation due to familiarity and superior information, or some other mechanism.

Table 3 reports point estimates of the elasticity of the reservation FFW wage with respect to the principal regressors. Doubling household labour supply, other things held constant, reduces household FFW reservation wage 19–51 per cent. Past FFW participation history also has a negative effect, with an elasticity of up to negative eight percent. On the other hand, increasing household endowments of land and especially livestock exert significant upward pressure on reservation wage rates. Doubling livestock holdings – which averaged about 2.5 TLU per household in this sample – would be expected to increase the reservation wage by 40–65 per cent, with the elasticity of the reservation wage with respect to land holdings about half that level. FFW reservation wages, and thus the economic surplus households derive from participation, appears to vary considerably across households based on their endowments of productive assets and past FFW participation, not just based on income levels.[24]

CONCLUSIONS AND IMPLICATIONS

Both the research and policy-making communities have shown considerable interest in identifying mechanisms that might improve the targeting of

TABLE 3

ELASTICITY ESTIMATES OF FFW RESERVATION WAGE, BY FORM OF PAYMENT
(estimated at sample means)

	Cash	Maize	Red Wheat	White Wheat
Income	0.327	0.249	0.248	0.263
Labor	–0.509	–0.186	–0.308	–0.431
Land	0.378	0.294	0.158	0.294
Livestock	0.621	0.401	0.571	0.654
Prior Years FFW	–0.024	–0.041	–0.078	–0.051

transfers to needy beneficiaries. Self-targeting mechanisms such as food for work have attracted particular attention because of their purported ability to induce self-selection out of the pool by the relatively well-off, thereby enabling concentration of transfer resources on the neediest sub-populations with minimum expenditure on administration. We applaud the general direction of these efforts. None the less, in this article we call attention to an important oversight in the existing literature on self-targeting: its dependence on households facing a parametric wage, or, put differently, the existence of complete and competitive factor markets. Since imperfect factor markets plague many settings where FFW is deployed, including rural Ethiopia, the case we study, this oversight matters.

Rural Ethiopian households' declared reservation wage rates for FFW participation reveal significant errors of both exclusion and inclusion. These errors appear unlikely to be resolved by simply dropping the FFW wage, as revealed by a shallowly sloped estimated participation probability function. More fundamentally, Ethiopian households' revealed preferences appear perfectly consistent with a simple structural model that allows for household-specific valuation of labour as a function of relative factor endowments and human capital characteristics, with an added premium for public project participation that depends on one's history of past participation and one's perception of the stigma associated with participation. Because per capita endowments of productive non-labour assets such as land or livestock are negatively correlated with per capita income in rural Ethiopia, the resulting negative partial correlation between income and household labour productivity works at cross-purposes with the demand-for-leisure and returns-to-skills effects on which self-targeting relies. Hence the observed errors of exclusion and inclusion, relative to household per capita incomes, in a uniform FFW wage programme.

But just because self-targeting FFW is less effective than is sometimes believed, this does not mean it cannot perform as well as other targeting methods in reaching a target vulnerable subpopulation with a fixed stock of transfer resources [*Barrett et al., 2002*]. Indicator targeting based on geography, age or gender has a demonstrably poor record in Ethiopia as well [*Clay et al., 1999; Jayne et al., 2002*]. Our results should instead be interpreted as debunking as overly optimistic any expectations that self-targeting can effectively reach the poor without costly, complementary targeting methods. One possibility our results raise is that of indicator-cum-self-targeting, wherein different wage rates are offered to identifiably different types of people: women versus men, past programme participants versus new ones, residents in one area versus another and so on. Another possibility is self-targeting at a market, or even above-market wage rate for those who satisfy an indicator-based eligibility standard, for example by

making FFW available only to those with less than a certain amount of land or oxen or both, or more than a certain, high percentage of children among household members.

Our results also lend further empirical support to the hard questions others, such as Drèze and Sen [*1990*], have raised about the form in which transfers intended to relieve food insecurity might best be delivered. By comparing reservation FFW wages across payment forms, we find a substantial fungibility premium associated with cash versus in kind payment. FFW projects could employ about one-quarter more people if wages were paid at the same modal rate (about five kilograms per day), but in cash instead of in grain. In order to justify the markedly greater cost of distributing a less desirable good that is more expensive to transport and store, FFW project directors should be required to demonstrate a problem in inducing private traders to deliver food to local markets at prices FFW participants could pay based on cash transfers. Surely there are cases where such problems exist. But we suspect transfer budgets could help more people better by ending the use of grain as the default payment form.[25]

The accuracy of self-targeting may leave much to be desired in places like Ethiopia where factor market failures are ubiquitous. None the less, this does not mean that FFW cannot work, nor does it reject the possibility that FFW might even be the most effective among a range of relatively ineffective means of assisting the poor. The problem is not the targeting mechanisms. Rather it is the underlying, structural weaknesses of many rural economies in low-income countries. The very rural market imperfections that help foster the poverty motivating transfers also restrict policy-makers' ability to use an otherwise-cost-effective transfer mechanism. The hard reality is that it may be hardest to reach the truly needy where the need is greatest.

final revision accepted February 2002

NOTES

1. Some good reviews can be found in Besley and Kanbur [*1988*], Lipton and van der Gaag [*1993*], van de Walle and Nead [*1995*], Sharp [*1997*], Devereux [*1999*] and Barrett [*2002*].
2. Clay [*1986*], Besley and Kanbur [*1988*], Ravallion [*1990, 1991*] and von Braun [*1995*] present the theory and much empirical evidence on the efficacy of such schemes.
3. Herring and Edwards [*1983*] tell an interesting story of manipulation and corruption that arise due to the many different opportunities for local FFW managers to exercise discretion (for example, over project duration, location, wage rates, payment terms, etc.) and how this may affect participation profiles, even in a seemingly successful programme like Maharashtra's Employment Guarantee Scheme.
4. Data available electronically at http://www.wfp.org/reports/wfpstats/98/table6.htm.
5. Under the auspices of the USAID-funded Grain Market Research Project, implemented by Michigan State University.
6. The questions were translated into local languages in the fielded questionnaires.

7. Since we are concerned about the potential role of stigma in causing households to demand a higher FFW wage, we also considered the possibility that this omission might lead to sample selection bias, but a probit model to estimate selectivity into the sub-sample of respondents to this elicitation process proved uninformative.
8. The supply curve is estimated by aggregating across households weighted by the inverse of their sampling probability (that is, the number of households in the population they 'represent' in the survey).
9. The ray elasticities for white wheat and cash (in white wheat equivalents) are two or greater up to four kilograms, but below 0.6 beyond seven kilograms. Qualitatively similar patterns emerge for red wheat and maize.
10. Note that this premium estimate ignores the additional costs of procurement, transport, storage, handling and loss of physical commodities, which only magnify the differences between food and cash distributions.
11. Our finding is therefore consistent with the well-established 'cash-out puzzle' related to welfare transfers more generally.
12. The declining premium likely reflects the fixed cost associated with selling food. Unit average receipts net of sales expenses tend to rise with sales volumes among smallholders.
13. This variable takes value one if the household was willing to participate in the programme at the indicated wage rate (or a lower one) and zero otherwise.
14. Qualitatively identical patterns emerge for other reservation wage rates. These three were chosen as illustrative of the broader pattern.
15. The literature on public assistance programmes in the United States pays considerable attention to the possible role of stigma in impeding participation by eligible households [*Moffitt, 1992; Barrett, 2002*]. Sen [*1995*] relatedly notes that participation in public employment schemes likely depends in part on issues of self-respect and independence.
16. The literature on non-separable household modelling offers many possible explanations for household market non-participation, including risk, transactions costs, asymmetric information or contract enforcement problems and so on [*Singh et al., 1986; De Janvry et al., 1991*]. The reasons for household-specific markets failure are not of direct concern in this article.
17. This observation has spawned an important recent literature on structural labour supply estimation in low-income agriculture [*Jacoby, 1993; Newman and Gertler, 1994; Skoufias, 1994; Barrett et al., 2000*].
18. A more formal, mathematical treatment can be found in Jacoby [*1993*], Newman and Gertler [*1994*] or Barrett *et al.* [*2000*].
19. Barrett, Reardon and Webb [*2001*] report on a set of studies from rural Africa that collectively exhibit high and variable rates of labour market non-participation by farm households.
20. Officially, all land in Ethiopia is owned by the state, although sales and rentals do exist. Regular land redistribution by the government and poor infrastructure have a significant effect on factor market performance in the country, as a number of recent studies document meticulously [*Holden et al., 2001; Pender and Fafchamps, 2001*].
21. This may be because members are less likely to perish or to outmigrate or because these households are more likely to retain adult children and other relatives because they are able to provide for them. Whatever the demographic dynamic behind the positive correlation between income and household labour force size, it may affect household reservation FFW wage in an environment of imperfect markets for labour and land.
22. In the cash payment model, the upper censoring limit is 18 birr rather than 10 kilograms.
23. Controlling for unobserved spatial heterogeneity comes at the price of additional degrees of freedom lost in adjusting for the 53 location-specific means. All reported standard errors have been adjusted for the correct degrees of freedom.
24. Ideally, one wants to relate the FFW reservation wage to a money metric measure of utility. The income variable described in the Appendix is plainly an imperfect measure of money metric utility (as is any income, expenditure, anthropometric or other variable). As an anonymous referee points out, mis-measurement of income could generate a spurious non-zero correlation between productive asset endowments (for example, land, livestock, labour,

education) and the FFW reservation wage rate. It is thus quite likely that our estimates overstate both the true relation between these asset holdings and reservation wages and the true variability in the unconditional relation between income and reservation wages. We think it extraordinarily unlikely, however, that income mismeasurement would come anywhere near to explaining away the apparently weak unconditional relation between income and FFW reservation wages that motivates this study.

25. This of course raises the difficult issue of form-dependent resource availability. If food is the only form in which resources are available to provide transfers, in kind transfers may be a second best solution.

REFERENCES

Arrow, K., Solow, R., Portney, P.R., Leames, E.E., Radner, R. and H. Schuman, 1993, 'Report of the NOAA Panel on Contingent Valuation', *Federal Register*, 15 Jan., Vol.58, No.105, pp.4601–14

Barrett, C.B., 2002, 'Food Security and Food Assistance Programs', in B. Gardner and G. Rausser (eds.), *Handbook of Agricultural Economics*, Amsterdam: Elsevier Science.

Barrett, C.B. and P.A. Dorosh, 1996, 'Farmers' Welfare and Changing Food Prices: Nonparametric Evidence From Rice In Madagascar', *American Journal of Agricultural Economics*, Vol.78, No.3, pp.656–69.

Barrett, C.B., Holden, S. and D.C. Clay, forthcoming, 'Can Food-for-Work Programmes Reduce Vulnerability?' in S. Dercon (ed.), *Insurance Against Poverty*, Helsinki: World Institute for Development Economics Research.

Barrett, C.B., Reardon, T. and P. Webb, 2001, 'Nonfarm Income Diversification and Household Livelihood Strategies in Rural Africa: Concepts, Dynamics and Policy Implications', *Food Policy*, Vol.26, No.4, pp.315–31.

Barrett, C.B., Sherlund, S.M. and A.A. Adesina, 2000, 'Shadow Wages, Allocative Inefficiency, and Labour Supply in Smallholder Agriculture', paper presented at the winter meetings of the Econometric Society.

Besley, T. and R. Kanbur, 1988, 'Principles of Targeting', in Michael Lipton and Jacques van der Gaag (eds.), *Including the Poor*, Washington, DC: World Bank.

Clay, D.C., Molla, D. and D. Habtewold, 1999, 'Food Aid Targeting in Ethiopia: A Study of Who Needs It and Who Gets It', *Food Policy*, Vol.24, pp.391–409.

Clay, E.J., 1986, 'Rural Public Works and Food-for-Work: A Survey', *World Development*, Vol.14, No.10/11, pp.1237–86.

Coppock, D.L. (ed.), 1994, *The Borana Plateau of Southern Ethiopia: Synthesis of Pastoral Development, Research and Change, 1980–91*. Addis Ababa: International Livestock Centre for Africa.

De Janvry, A., Fafchamps, M. and E. Sadoulet, 1991, 'Peasant Household Behaviour with Missing Markets: Some Paradoxes Explained', *Economic Journal*, Vol.101, pp.1400–17.

Devereux, S., 1999, 'Targeting Transfers: Innovative Solutions to Familiar Problems', *IDS Bulletin*, Vol.30, No.2, pp.61–74.

Drèze, J. and A. Sen, 1990, *Hunger and Public Action*, Oxford: Oxford University Press.

FDRE, 1996, *Food Security Strategy 1996*, Federal Democratic Republic of Ethiopia, Addis Ababa.

Gebremedhin, B. and S.M. Swinton, 2000, 'Reconciling Food-for-Work Project Feasibility with Food Aid Targeting in Tigray, Ethiopia', *Food Policy*, Vol.26, No.1, pp.85–95.

Herring, R.J. and R.M. Edwards, 1983, 'Guaranteeing Employment to the Rural Poor: Social Functions and Class Interests in the Employment Guarantee Scheme in Western India', *World Development*, Vol.11, No.7, pp.575–92.

Holden, S., Shiferaw, B. and J. Pender, 2001, 'Market Imperfections and Land Productivity in the Ethiopian Highlands', *Journal of Agricultural Economics*, Vol.52, No.3.

Holloway, G.J., Barrett, C.B. and S. Ehvi, 2000, 'Innovation and Market Creation, *Journal of the American Statistical Association*, pp.148–53.

Jacoby, H.G., 1993, 'Shadow Wages and Peasant Family Labour Supply: An Econometric Application to the Peruvian Sierra', *Review of Economic Studies*, Vol.60, No.3, pp.903–21.

Jalan, J. and M. Ravallion, 2000, 'Income Gains to the Poor From Workfare: Estimates for Argentina's Trabajar Program', unpublished World Bank manuscript.
Jayne, T.S., Strauss, J. and T. Yamano, forthcoming, 'Targeting of Food Aid in Rural Ethiopia: Chronic Need or Inertia', *Journal of Development Economics*.
Kanbur, R. Keen, M. and M. Tuomala, 1994, 'Labour Supply and Targeting in Poverty Alleviation Programs', *World Bank Economic Review*, Vol.2, No.2, pp.191–211.
Lipton, M. and J. van der Gaag (eds.), 1993, *Including the Poor*, Washington, DC: World Bank.
Moffitt, R., 1992, 'Incentive Effects of the U.S. Welfare System: A Review', *Journal of Economic Literature*, Vol.30, No.1, pp.1–61.
Newman, J.L. and P.J. Gertler, 1994, 'Family Productivity, Labour Supply, and Welfare in a Low Income Country', *Journal of Human Resources*, Vol.29, No.4, pp.989–1026.
Ravallion, M., 1990, 'On the Coverage of Public Employment Schemes for Poverty Alleviation', *Journal of Development Economics*, Vol.34, No.1, pp.57–79.
Ravallion, M., 1991, 'Reaching the Rural Poor through Public Employment: Arguments, Lessons, and Evidence from South Asia', *World Bank Research Observer*, Vol.6, No.1, pp.153–76.
Ravallion, M., Datt, G. and S. Chaudhuri, 1993, 'Does Maharashtra's Employment Guarantee Scheme Guarantee Employment? Effects of the 1988 Wage Increase', *Economic Development and Cultural Change*, Vol.41, No.2, pp.251–75.
Sahn, D.E. and H. Alderman, 1996, 'The Effect of Food Subsidies on Labour Supply in Sri Lanka', *Economic Development and Cultural Change*, Vol.1, pp.125–45.
Sahn, D.E., Younger, S.D. and K.R. Simler, 1999, 'Dominance Testing of Transfers in Romania', Cornell Food and Nutrition Policy programme Working Paper 78.
Sen, A., 1995, 'The Political Economy of Targeting', in D. van de Walle and K. Nead (eds.), *Public Spending and the Poor*, Baltimore, MD: Johns Hopkins University Press.
Sharp, K., 1997, *Targeting Food Aid in Ethiopia*, Addis Ababa: Save the Children Fund (UK).
Singh, I., Squire, L. and J. Strass (eds.), 1986, *Agricultural Household Models*, Baltimore, MD: Johns Hopkins University Press.
Skoufias, E., 1994, 'Using Shadow Wages to Estimate Labour Supply of Agricultural Households', *American Journal of Agricultural Economics*, Vol.76, No.2, pp.215–27.
Southworth, H., 1945, 'The Economics of Public Measures to Subsidize Food', *Journal of Farm Economics*, Vol.68, No.1, pp.37–43.
Teklu, T. and S. Asefa, 1999, 'Who Participates in Labor-Intensive Public Works in Sub-Saharan Africa? Evidence from Rural Botswana and Kenya', *World Development*, Vol.27, No.2, pp.431–8.
van de Walle, D. and K. Nead (eds.), 1995, *Public Spending and the Poor*, Baltimore, MD: Johns Hopkins University Press.
von Braun, J. (ed.), 1995, *Employment for Poverty Reduction and Food Security*, Washington, DC: International Food Policy Research Institute.
von Braun, J., Teklu, T. and P. Webb, 1999, *Famine in Africa: Causes, Responses and Prevention*, Baltimore, MD: Johns Hopkins University Press.

APPENDIX A

VARIABLE DEFINITIONS

Household Income. Gross household income is computed as the sum of: (1) the value of own production for all major food crops during the 1995 *meher* season as measured by standard crop-cutting methods employed by field agents of the Ethiopia Central Statistical Authority; (2) the self-reported value of non-food crops; (3) the value of 20 per cent (estimated mean off-take rate) of total livestock;[1] and (4) total cash income earned by household members during the preceding 12 months. From this sum of inflows we subtracted the cash costs of all crop inputs, primarily fertiliser. The principal agricultural production season in Ethiopia, *meher*, has a harvest from September through December, depending on crop and region of the country. No adjustments were made for cereal production during the *belg* harvest due to unreliable data for this secondary seasonal harvest, which accounts for less than ten percent of total grain harvest nationally.

Household labour/Adult equivalents include children aged 10–14 and seniors age 65 and beyond at half weight, with no difference in gender. Only current residents of the household were included. Because benefit incidence can be sensitive to the particular, inherently contestable household equivalence scales used [*Sahn et al., 1999*], we reestimated the models using several alternatives. The findings reported here using a simple, crude scale appear robust to the choice of scale.

Land is measured as operational holdings of the household in hectares during the *meher* season. *Tropical Livestock Units (TLU)* follows the International Livestock Centre for Africa standards for Ethiopia. Livestock to TLU conversion ratios are: cows = 0.7, sheep = 0.1, goats = 0.1, horses = 0.8, donkeys = 0.5, mules = 0.7, and camels = 1.0.

Average annual rainfall over the previous five years by farmer association or *wereda*, captured from national meteorological data.

Lower social standing is a dummy variable taking value one if the household replied that it believed FFW participation would lower its social standing.

FFW receipts are the number of years in the past five in which the household received food for work distributions.

Free food aid receipts represents the number of years in the previous five in which the household received free food distributions.

Literate w/o primary schooling is a dummy variable taking value one for households whose heads can read and write yet have not completed primary school.

Primary schooling completed is a dummy variable taking value one for households whose heads have completed primary school or above.

Age of HH head is the age in years of the head of household.

Female HH head is a dummy variable where female = 1, and male = 0.

NOTE

1. The 20 per cent income flow estimate for livestock is based on published studies of the Ethiopian livestock sector [e.g., *Coppock, 1994; Holloway et al., 2000*], consultations with our Ethiopian collabourators, and the survey data. One referee expresses concern that these are largely draft animals. Yet 22 per cent of the livestock TLU are non-cattle, mainly goats, poultry and sheep, which are definitely providing consumption goods rather than draft services, and the vast majority of the cattle are found in herds of more than two head, the common maximum size of highland draft herds. Sixty-four per cent of households held more than two cattle, and 19 per cent held more than six. This underscores that a significant share of Ethiopia's rural population, especially in the south and west and in the peri-urban areas, are either pastoralists or agropastoralists who derive most of their total income from milk and blood, or smallholder dairy producers who generate significant milk output. Add to this meat offtake – one of Ethiopia's largest exports – and it is apparent that there is indeed a significant direct flow of income from livestock. They are not just an asset stock.