Can Social Protection Work in Africa? The Impact of Ethiopia's Productive Safety Net Programme

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I. Introduction

In the last 20 years, social safety nets—targeted noncontributory transfer programs—have gone from the periphery to the mainstream of discourse on poverty reduction (Grosh et al. 2008). Along with this has come an abundance of studies that assess their effectiveness. There is an extensive body of literature on the efficacy of conditional cash transfer programs (Fiszbein and Schady 2009; Adato and Hoddinott 2010; and the papers that appeared in an April 2009 symposium in *Economic Development and Cultural Change*), public works (Subbarao et al. 1997), and an extensive review of all types of social safety net interventions in Grosh et al. (2008). But missing from this literature are rigorous assessments of social protection programs in Africa. Although the growth of social protection programs in Africa started later than in Latin America and elsewhere, social protection programs are now common in Africa.[1] While several studies have carefully assessed components of social protection in South Africa (see, e.g., Case and Deaton [1998] on the Old Age

This work has been funded under World Bank Award 100025484/2010 with additional funding from the Department for International Development (DfID) and the US Agency for International Development (USAID) as well as funding provided by the CGIAR's Policy, Institutions and Markets research program to IFPRI. The material presented here would not have been available without the superb work undertaken by the Ethiopian Central Statistical Agency (CSA) in implementing the household and community surveys on which this report is based. We especially thank Weizro Samia Zekaria, director general of the CSA, for her support. Discussions with Harold Alderman, the late Ato Birhane, Ato Berhanu Wolde-Micheal, Sarah Coll-Black, Mulugeta Handino, Matt Hobson, Jeremy Lind, Suzanne Poland, Tim Robertson, Rachel Sabates-Wheeler, Judith Sanford, Wout Soer, Mulugeta Tefera, Cate Turton, William Wiseman, participants at the BASIS Conference on Escaping Poverty Traps, and comments received from participants in workshops held in Addis Ababa in 2007, 2008, 2009, and 2011, and in Awassa, Bahir Dar, and Mekelle in August 2011, have been invaluable. We have also benefited from comments received from two referees, an associate editor, and from John Strauss. Errors are ours. Contact the corresponding author, John Hoddinott, at j.hoddinott@cgiar. org.

[1] From 2000 to 2010, the World Bank funded 60 social protection programs in 23 countries in Africa, with the largest being the PSNP and associated programs in Ethiopia (http://go.worldbank. org/0J6HJD0AK0).

Electronically published September 2, 2014

Pension; and Case, Hosegood, and Lund [2005] on the Child Support Grant), in the words of one recent review, "Much of the research and evidence from existing social transfer programmes in low-income countries in sub-Saharan Africa is not considered sufficiently rigorous to influence senior decision-makers" (Save the Children 2009, 3), with the result that "many decision-makers both from national governments and donor governments remain unconvinced that such programmes are a worthwhile investment" (Save the Children 2009, 2).

This study seeks to partially fill this lacuna by providing an evaluation of a large-scale social protection program in rural Ethiopia, the Productive Safety Net Programme (PSNP). This is of interest because, unlike many other social protection programs in sub-Saharan Africa, the PSNP was implemented at scale. It operates with an annual budget of approximately US$500 million, providing direct benefits to approximately 1 million participants and their households. Ethiopia is one of Africa's poorest countries, with limited physical and communications infrastructure and scarce administrative resources. To paraphrase Frank Sinatra, if social protection can make it here, it can make it (almost) anywhere. A unique feature of the PSNP was its explicit link to interventions designed to increase agricultural productivity, thus making it possible to assess whether the joint effect of such interventions is greater than just providing transfers. Finally, participants in the PSNP have very low asset levels; such households, it has been argued, when faced with negative income shocks, choose to "smooth assets" rather than smooth consumption (Zimmerman and Carter 2003; Carter and Barrett 2006). Our data allow us to assess the converse of this proposition: do such households, when faced with a positive income shock, increase consumption (as designers of the intervention had assumed), or do they accumulate assets?

The article begins with a brief description of the PSNP. We review the data and methods that we use before providing contextual information within which this evaluation is placed. We then report and discuss our estimates of impact.

II. The Productive Safety Net Program

Between 1993 and 2004, the government of Ethiopia launched near-annual emergency appeals for food aid and other forms of emergency assistance.[2] While these succeeded in averting mass starvation, especially among the assetless, they did not banish the threat of further famine, and they did not prevent asset depletion by marginally poor households affected by adverse rainfall shocks.

[2] Aspects of the effectiveness of these appeals are assessed in Jayne, Strauss, and Yamano (2001), Jayne et al. (2002), Lautze et al. (2003), and Gilligan and Hoddinott (2007).

Further, the ad hoc nature of these responses meant that the provision of emergency assistance—often in the form of food-for-work programs—was not integrated into ongoing economic development activities (Subbarao and Smith 2003). Starting in 2005, the government of Ethiopia and a consortium of donors implemented a new response to chronic food insecurity in rural Ethiopia. Rather than annual appeals for assistance and ad hoc distributions, a new program called the Productive Safety Net Programme (PSNP) was established.

The objective of the PSNP is "to provide transfers to the food insecure population in chronically food insecure *woredas* in a way that prevents asset depletion at the household level and creates assets at the community level" (GFDRE 2004, 2009a, 2010). Unlike the annual emergency appeals, it was conceived as a multiyear program so as to provide recipients with predictable and reliable transfers. Most beneficiary households do Public Works (PW): criteria for selection into these are that these households are poor (e.g., they have low holdings of land and/or cattle) and food insecure, but they also have able-bodied labor power. A much smaller proportion of beneficiaries receive Direct Support (DS): these households are poorer than those receiving Public Works employment and lack labor power; this includes those whose primary income earners are elderly or disabled. From 2005 to 2007, the PW component paid beneficiaries either 6 birr per day (increased to 8 birr in 2008 and 10 birr in 2010) in cash or 3 kilograms of cereals for work (depending on where they lived) on labor-intensive projects building community assets. Most PW activities occur between the months of January and June to leave beneficiary households with time for their own farming activities, which occur in the second half of the year.

The PSNP uses a mix of geographic and community-based targeting to identify chronically food-insecure households in chronically food-insecure *woredas*.[3] When the program began in 2005, initially 190 *woredas* were selected on the basis of historical data on food aid allocations.[4] These data were also used to determine the number of eligible beneficiaries in each region and *woreda*. This meant that coverage of the program was higher in the historically famine-prone northern regions of Tigray and Amhara and lower in Oromiya and Southern Nations, Nationalities, and People's Region (SNNPR). Within *woredas*, local administrators selected the chronically food-insecure *kebeles*, assigning the *woreda's* "PSNP quota" among these areas. Household-level targeting for the PSNP focused on selecting households with high levels of food

[3] A *woreda* is equivalent to a county or district. A *kebele* is like a township within a county.

[4] The number of *woredas* covered by the PSNP has increased over time, partly as larger *woredas* have been split in two and partly because of the expansion of the program. There are now over 300 PSNP *woredas* in Ethiopia.

insecurity and which had been recipients of past emergency food aid. Having made the initial selection based on the basic criteria, the following characteristics were used to verify and refine the selection of eligible households: household assets (landholdings, oxen) and income from nonagricultural activities and from alternative sources of employment. However, communities were given substantial discretion to modify this approach and to update their lists of food-insecure households annually based on local criteria. So, for example, households who suddenly became more food insecure as a result of a severe loss of assets and were unable to support themselves, as well as any household without family support and other means of social protection and support could be included in beneficiary lists.[5]

Initially, the PSNP was complemented by a series of food security activities, collectively referred to as the Other Food Security Programme (OFSP). While the PSNP is designed to protect existing assets and ensure a minimum level of food consumption, the OFSP is designed to encourage households to increase incomes generated from agricultural activities and to build up assets. The OFSP included access to credit; assistance in obtaining livestock, small stock, or bees; tools; seeds; and assistance with irrigation or water-harvesting schemes, soil conservation, and improvements in pastureland. However, relatively few households have had access to the OFSP (Gilligan et al. 2009). This limited coverage reflected a number of other challenges associated with its implementation. One challenge was that the agricultural extension system was underresourced and development agents (DAs) did not have the training or skills to support the OFSP effectively (World Bank 2009). Focus group discussions and key informant interviews revealed that in the absence of guidelines on OFSP implementation, there was considerable regional variation in the targeting of the OFSP. There was also considerable confusion surrounding credit provision and repayment.

Given these problems, the Ethiopian government, in collaboration with donors and development partners, extensively redesigned the OFSP in 2009 and introduced a new program called the Household Assets Building Program (HABP). The HABP differs from the OFSP in three ways. Along with the injection of new resources, there is an emphasis on increased contact and coordination with agricultural extension services. Each *kebele* is to have three development agents who specialize in crop science, animal husbandry, and natural resources management. They disseminate "technology packages" and provide on-farm technical advice. Second, credit services have been delinked

[5] See Coll-Black et al. (2012) for an assessment of the targeting of the PSNP.

from the extension service. Instead, credit will be provided through microfinance institutions and Rural Savings and Credit Cooperatives. A third significant change has been the clarification of access to the HABP—specifically, PSNP clients are to be prioritized for support under HABP (GFDRE 2009b). This has led to an improvement in support provided by DAs. In the 2010 survey round, many households reported contact with development agents and noted that they received advice about new crops and how crops can be grown. However, assistance remains concentrated on crop production. There is limited capacity to assist nonagricultural enterprises. Access to new forms of credit has been limited. Relatively few households reported borrowing money to purchase inputs or to buy livestock (Berhane et al. 2011).

III. Data, Methods, and Contexts

A. Sample Design

Our analysis is based on longitudinal survey data collected at the household and locality levels. These data were collected in the four major regions covered by the PSNP; from north to south these are Tigray, Amhara, Oromiya, and Southern Nations, Nationalities, and People's Region (SNNPR). The first survey was implemented in June–August 2006, with the bulk of the interviewing conducted in July. A second round was fielded between late May and early July 2008, and the most recent (third) round in June and July 2010. Consequently, seasonality considerations are unlikely to confound comparisons made across rounds. The structure and content of the questionnaires remained largely unchanged across survey rounds. This comparability means that interpreting changes in outcomes over time is not confounded by changes in the questions used to elicit these data.

The sample was constructed by randomly sampling *woredas* proportional to size from a list of chronically food-insecure *woredas* stratified by region where the PSNP was operating in 2006.[6] Within each *woreda*, enumeration areas (EAs) were randomly selected from *kebeles* where the PSNP was operating. Within each EA, 15 beneficiary and 10 nonbeneficiary households were sampled from separate lists for each group, yielding a sample of 25 households per EA. This procedure yielded a sample of 146 EAs and, because a few sampled households were not interviewed, a sample of 3,688 households.[7] Across all three rounds, 3,140 households appear in all rounds, yield-

[6] Note that this design means that we exclude *woredas* that were added to the program after 2006.

[7] The sample size was calculated so as to be large enough to identify an effect size equivalent to a 10-percentage-point increase in the proportion of households that were not food insecure as defined by the food gap. Seeking statistical power of 80% and a significance level of .05, we found that

ing an attrition rate of 14.8% or, over 5 years, just under 3% per year. Berhane et al. (2011) investigate whether potential differences in attrition rates can be attributed to differences in baseline characteristics by examining the correlation of the probability of attrition with household characteristics and region dummies. They show that being a beneficiary was not highly correlated with the probability of attrition. Older and smaller households were slightly more likely to attrite than other household types, but the impact of these characteristics on attrition was small.

The household questionnaire was complemented by a questionnaire administered at the community. This covered the following topics: location and access, water and electricity, services, education and health facilities, production and marketing, migration, wages, prices of food grains in the last year, and operational aspects of the PSNP. In addition, a price questionnaire obtained detailed information on current food prices.

B. Impact Estimation Methods

The simplest way of assessing the impact of the PSNP would be to compare mean outcomes for households that benefit from these programs to those who do not. The problem with such an approach is that beneficiary households are likely to be systematically different from nonbeneficiary households for many reasons in addition to their participation in the PSNP, and these factors also affect food security. For example, as shown in Berhane et al. (2011), beneficiary households are poorer on average. As a result, observed differences in unconditional means are biased estimates of impact; they reflect PSNP beneficiary status and these other characteristics.

Our evaluation strategy addresses this bias in several ways, including estimating "difference-in-differences" (DID) models of program impact as well as using matching methods based on a dose-response model of transfers received to construct the comparison group. The DID estimator is defined as the average change in the outcome in a treatment group minus the average change in the outcome in a comparison group. DID estimates remove the effect of any unobserved variables that represent persistent (time-invariant) differences between the treatment and comparison groups. This helps to control for the fixed component of various contextual differences between treatment and comparison groups, including depth of markets, agro-climatic conditions, and any persistent differences in infrastructure development.

62 sample clusters were required. To account for additional sampling of *kebele* subclusters within the EA and unbalanced samples of beneficiaries and nonbeneficiaries, it was decided to be conservative and include 68 *woredas* as sample clusters.

Central to the implementation of DID is the construction of the treatment and comparison groups so that, at baseline, they are as comparable as possible. One approach to constructing such a comparison group is to randomly provide access to the program among similarly eligible households. However, because allocation of the PSNP was not randomized, this method was not feasible. In earlier work based on the 2006 and 2008 survey rounds, we used matching methods to construct a comparison group by "matching" treatment households to comparison group households based on observable characteristics (Gilligan et al. 2007; Gilligan, Hoddinott, and Taffesse 2009). This approach relied on the construction of a comparison group that had comparable observable characteristics but did not receive PSNP benefits. Although this method was effective at estimating impacts using early rounds of the survey, Berhane et al. (2011) show that over time, there has been considerable movement in and out of the PSNP as a result of retargeting, transitory shocks, and changes in resource allocations, with the result that the number of households in our sample that have never received the PSNP has shrunk. Also, by definition, these households are observably different from current and past beneficiaries; over a 5-year period they have never been deemed sufficiently food insecure to warrant inclusion in the program. In preliminary work not reported here, we experimented extensively with definitions of program participation and with covariates used to match households defined as participants with nonparticipants. We found that the number of comparison households was often less than 200, making it difficult to produce robust, consistent impact estimates.

Given this, we use an extension of propensity score matching methods developed by Hirano and Imbens (2004) where treatment is continuous. Define $\mathcal{T}$ as the set of all treatment levels and T as a specific treatment level. Define the treatment interval $\mathcal{T} = [t_0, t_1]$, so that $T \in [\mathrm{t}_0, \mathrm{t}_1]$.[8] We are interested in calculating the average dose-response function, $\mu(t) = E[Y(t)]$, where Y is a given program outcome. Hirano and Imbens note that the unconfoundedness assumption in the binary case can be generalized to the case where T is continuous. This assumption, referred to as "weak unconfoundedness," takes the form

$$Y(t) \perp T \mid X \ \forall \ t \in \mathcal{T} \tag{1}$$

and requires only conditional independence of Y at each value of the treatment, rather than joint independence of all potential outcomes. They define

[8] In the case of dichotomous treatment, $\mathcal{T} = D$ where $D \in \{0, 1\}$.

the generalized propensity score (GPS), R, as $R = r(T, X)$. They note that "the GPS has a balancing property similar to that of the standard propensity score. Within strata with the same value of $r(T, X)$ the probability that $T = t$ does not depend on the value of X" (Hirano and Imbens 2004, 2). Hirano and Imbens prove that if assignment to treatment is weakly unconfounded given X, then it is weakly unconfounded given the generalized propensity score.

To implement their approach, we first estimate the values of the GPS. We assume that the treatment variable is normally distributed, conditional on the covariates X:

$$g(T)|X \sim N\{h(\gamma, X), \sigma^2\}. \tag{2}$$

We use two sets of covariates. The first set includes preprogram characteristics. As discussed in Coll-Black et al. (2012), preintervention demographic characteristics of the household (age of head, household size as of 2004), wealth of the household (landholdings, number of oxen also as of 2004), shocks (drought, illness) experienced between 2004 and 2010 and household location (proportion of households experiencing drought shocks, changes in staple grain and cattle prices, all between 2006 and 2010), are correlated with the years of program participation and the outcomes we consider. The appendix shows the results of estimating (1) using maximum likelihood. We then calculate the GPS as

$$\check{\mathrm{R}}_i = [2\pi\sigma^2]^{(-0.5)}\exp[(-(2\sigma^2)^{-1})[g(T_i) - h(\gamma, x)]]. \tag{3}$$

Having done so, we test balancing properties. Following a suggestion by Kluve et al. (2007), we divide the sample into three equalizing sized groups based on the distribution of the treatment variable, cutting the sample at its tertiles. We then divide each group into five blocks by the quintiles of the GPS, using only the GPS distribution of households in that group. Within each block, we calculate differences in means of each element of X for households in a given block compared to households in the same group but in different blocks. As Kluve et al. note, this procedure tests whether, within each group, covariate means of households belonging to the particular treatment-level group are significantly different from those of households with a different treatment level but similar GPS. A weighted average over the five blocks in each treatment-level group is then used to calculate a t-statistic of the differences-in-means between the particular treatment-level group and all other groups. This procedure is repeated for each treatment-level group and each covariate. If adjustment for the GPS properly balances the covariates,

differences-in-means should not be statistically different from zero. With 33 covariates, we calculate 99 *t*-statistics and assess whether, at the 95 confidence levels, we reject the null hypothesis that the mean difference in covariates is zero. After adjusting for the GPS, there are only three *t*-statistics with values greater than 1.96, implying that the GPS successfully balances the covariates.

Having satisfied the balancing property, we estimate the conditional expectation of *Y*, given *T* and *R*. Initially, we use a linear specification that only includes the treatment level (years of PSNP transfers), the GPS, and the interaction of these two terms. We obtain a dose-response function by estimating the average potential outcome at specified levels of treatment and use bootstrap methods to calculate standard errors. Ex ante, we do not know the functional form the dose response takes, so we follow a suggestion found in Bia and Mattei (2008) and use a quadratic specification as a specification check. As this gives similar estimates, these are not reported here.

We use the results of these dose-response models to estimate the impact of the PSNP transfers by comparing households that received a high level of transfers (for the full 5 years of the program) to a matched comparison group of households that received only 1 year of transfers. Hirano and Imbens (2004) note that the value of the dose response at a particular level of treatment does not have a causal interpretation, but the difference in the dose response at two levels of treatment does have a causal interpretation. Households receiving only 1 year of PSNP transfers constitute a strong comparison group. They are likely to be similar to other beneficiaries in terms of observables and unobservables due to their eligibility, but they received a very low level of transfers on average.

In order to measure the impact of the PSNP alone as well as the impact of the PSNP and OFSP/HABP combined, we estimate the PSNP dose-response model separately for the sample that did not participate in the OFSP/HABP and for the sample that did receive the OFSP/HABP. This enables a rich set of comparisons of outcomes between levels of years of participation in the PSNP with and without access to the OFSP/HABP, as shown in table 1.

The columns in table 1 represent the two PSNP dose-response models estimated on the OFSP/HABP nonbeneficiary sample and OFSP/HABP beneficiary sample, respectively. Within either sample, differences in impacts between levels of PSNP participation (e.g., comparing B with A, say "B–A," or comparing D with C, say "D–C") are identified under the weak confoundedness assumption of Hirano and Imbens (2004). However, additional assumptions are needed when we compare levels of outcomes across the OFSP/HABP beneficiary and nonbeneficiary samples. When we compare, for example, outcomes of OFSP/HABP beneficiaries with 5 years of participation in the PSNP (D in table 1) with those of OFSP/HABP nonbeneficiaries with 5 years

TABLE 1
COMPARISONS OF TREATMENT EFFECTS FOR PSNP DOSE-RESPONSE MODELS AND PARTICIPATION IN THE OFSP/HABP

	OFSP/HABP Participation	
Level of PSNP Participation	OFSP/HABP Nonbeneficiaries	OFSP/HABP Beneficiaries
Low: 1 year of PSNP participation	A	C
High: 5 years of PSNP participation	B	D

Note. PSNP = Productive Safety Net Programme; OFSP = Other Food Security Programme; HABP = Household Assets Building Program.

of participation in the PSNP (B in table 1), these samples have not been matched within the same dose-response model. Instead, we are comparing outcomes at the highest level of PSNP treatment dosage across two samples. The identifying assumption for the comparison of D with B (comparison D–B) across dose-response models is that, conditional on the GPS for each model, the outcome variable of OFSP/HABP nonbeneficiaries with high level of PSNP transfers is the same as would occur for OFSP/HABP beneficiaries if they had not received the OFSP/HABP transfers but had received the high level of PSNP transfers. This is clearly a stronger identifying assumption than weak confoundedness conditional on the GPS for comparisons within dose-response models. However, selection bias should be reduced relative to a comparison of unadjusted mean outcomes between groups D and B, because mean outcomes in both samples have been adjusted by the GPS for a high level of PSNP participation within their samples. This should improve the comparability of the two samples. When comparing OFSP/HABP beneficiaries with the high level of PSNP participation with OFSP/HABP nonbeneficiaries with low PSNP participation (comparison D–A), identification is weaker still, although households that are very dissimilar to other PSNP beneficiaries should receive low weight in estimating means in either D or A due to adjustment for the GPS in each sample.

C. Defining Treatment

The 2006, 2008, and 2010 surveys provide payments data (both cash and in kind) for the following periods: January–May 2006, January 2007–May 2008, and January 2009–May 2010. The community price was used to value in-kind transfers. These values are added to cash payments received to generate the amount of total payments received over this period as well as telling us in which years payments were received. Note, however, that we do not have full payment data. Specifically, we are missing payment information for the

periods June 2006–December 2006 and June 2008–December 2008, and there is incomplete information on participation prior to January 2006.[9]

There are 1,872 households that received payments for Public Works in at least 1 year between 2006 and 2010: 31% are found in Tigray, 20% reside in Amhara, 25% live in Oromiya, and 24% are located in SNNPR. Approximately 35% of households receiving any PW payments do so in all 5 years between 2006 and 2010. This percentage is higher in SNNPR than in other highland regions. In Tigray, Amhara, and Oromiya, there is a relatively even distribution of households across the total number of years in which they received payments. Figure 1 shows the distribution of these payments, in 100-birr increments for households that received up to 7,500 birr. We exclude 43 households (2.2% of the sample) receiving more than 7,500 birr; in most cases, these are households with implausibly high levels of food transfers that may have possibly resulted from a misreporting of the quantities of food or the units in which these were reported. While figure 1 includes a wide range of values, the distribution is skewed to the left side of the distribution. Median transfers were 1,700 birr per beneficiary household. Relatively few—15%—received more than 3,500 birr.

The rows of table 2 refer to the number of years that a household received PW payments. The columns show the level of payments at different points in the distribution of payments for households receiving payments for 1 year only, for 2 years, and so on. Table 2 tells us that at any point in the distribution of payments, households that receive more years of Public Works payments received higher levels of total payments. Table 3 takes the data found in table 2 and divides them by the number of years that the household receives payments. This allows us to compare the distribution of average payments across the differing number of years of payments. It shows clearly that households with lengthier participation in the PSNP also received higher average payments than households with fewer years of participation. Last, a limitation of these payments data is that they do not take into account the fact that households of differing sizes had different payment entitlements. To remedy this, we calculate

[9] Over the period considered here, cash accounts for 55% of the value of all transfers. There are regional variations in the use of cash and food as the payment modality. In Tigray, more than 90% of the value of transfers was food. In SNNPR, nearly all transfers were in cash, while Amhara and Oromiya use a mix of food and cash. Initially there was an effort to gradually end the use of food, but this decision was reversed after the 2008 food crisis and, instead, a decision was made to provide a mix of food and cash. Approximately 74% of beneficiaries received food and 93% received cash. The receipt use of food and/or cash reflects several factors, including the availability of government and/or donor food stocks, the presence of banks, which are needed for cash disbursements, and regional and *woreda* preferences.

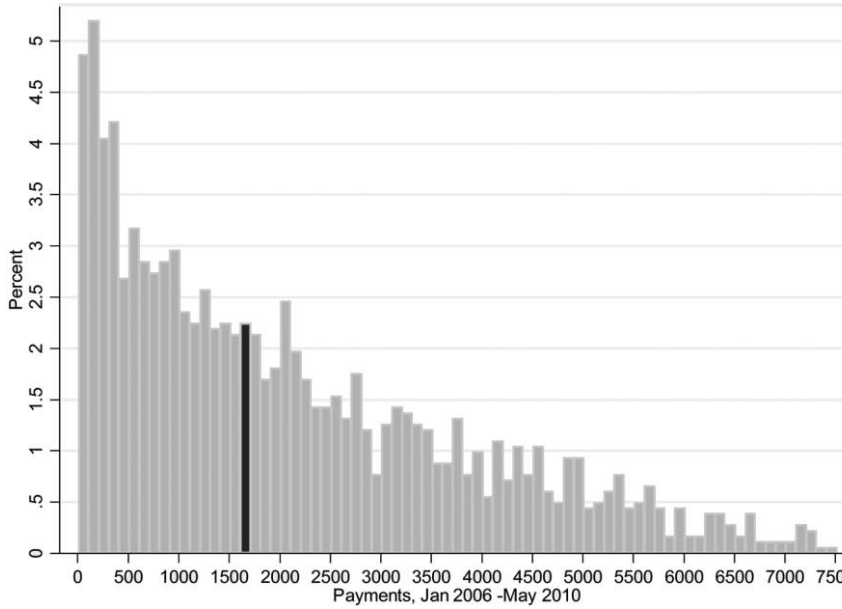

Figure 1. Distribution of Public Works payments: January 2006–May 2010

the percentage of entitlement that beneficiary households actually received.[10] The distribution of these percentages by number of years that a beneficiary receives PW payments is shown in figure 2.[11]

Given this information, how should we measure the "dosage" of Public Works? We could use the payments data, but these suffer from several problems. First, we need to deflate them, given the rapid changes in prices ob-

[10] This calculation of entitlements is complicated. Entitlements for 2006 and 2007 are calculated as 720 birr. This is based on a beneficiary household's entitlement to 20 days work per month for 6 months at a wage of 6 birr per day ($20 \times 6 \times 6 = 720$). The entitlement for 2008 is 960 birr, 20 days' work per month for 6 months at a wage of 8 birr per day. At the beginning of 2009, the calculation of entitlements was changed—it is calculated as household size multiplied by 5 days work per month for each family member multiplied by 6 months multiplied by a wage of 10 birr per day. A similar calculation is used to construct entitlement for 2010, but the household entitlement figure is multiplied by 0.83 because we only observe payments in the first 5 months of 2010 ($5/6 = 0.83$). For 2007 and 2009, we have a full 12 months of payment data. For 2006 and 2008 we multiply the payment data we observe by 1/0.83 on the assumption that the payments we observe between January and June represent five-sixths of the total payment that the household receives in that year. This figure, 1/0.83, corresponds to the modal ratio of payments that we see when we compare payments between January and May 2007 and 2009 with payments for all of 2007 and 2009, respectively.

[11] Following the evaluation of the PSNP in 2010, the government of Ethiopia took steps to increase payments relative to entitlements, and these ratios appear to have improved in 2012.

TABLE 2

DISTRIBUTION OF PAYMENTS (BIRR), BY NUMBER OF YEARS HOUSEHOLDS RECEIVE PUBLIC WORKS PAYMENTS

Number of Years Household Received Public Works Payments	Percentiles						
	1st	10th	25th	Median	75th	90th	99th
1	25	60	100	186	360	540	1,900
2	123	278	520	898	1,691	2,916	6,842
3	262	470	789	1,380	2,118	3,000	5,133
4	459	896	1,279	1,919	3,041	4,449	6,332
5	750	1,350	2,244	3,370	4,610	5,646	7,188
Total	51	210	630	1,650	3,180	4,783	6,800

Source. Household survey.
Note. Number of households by number of years receiving payments is 230, 196, 242, 277, and 569, respectively.

TABLE 3

DISTRIBUTION OF AVERAGE PAYMENTS (BIRR) PER YEAR, BY NUMBER OF YEARS HOUSEHOLDS RECEIVE PUBLIC WORKS PAYMENTS

Number of Years Household Received Public Works Payments	1st	10th	25th	Median	75th	90th	99th
1	25	60	100	186	360	540	1,900
2	62	139	260	449	846	1,458	3,421
3	87	157	263	460	706	1,000	1,711
4	115	224	320	480	760	1,112	1,583
5	150	270	449	674	922	1,129	1,438
Total	40	145	263	480	778	1,086	2,117

Source. Household survey.

served over this period. Also, as noted above, we do not observe all payment levels. Finally, payment levels by themselves do not take into account the fact that different households have different entitlements. We could focus on the number of payments that beneficiary households receive. However, doing so does not take into account differences in average payments received by different households. Measuring "dose" in terms of percent of entitlement received would seem to be promising, but again, recall that we do not observe all transfers. Further, it is difficult to compare these percentages when beneficiaries have differing numbers of years of participation. It is not obvious how we should compare the receipt of 40% of entitlement for 1 year compared to 10% for each of 4 years. By contrast, expressing the "dose" in terms of the number of years that households receive Public Works payments has several attractions. First, it is in keeping with a core feature of the PSNP, namely, that beneficiaries should receive multiyear program benefits. Second, as shown in tables 2 and 3 and in figure 2, the longer the duration of receipt of Public

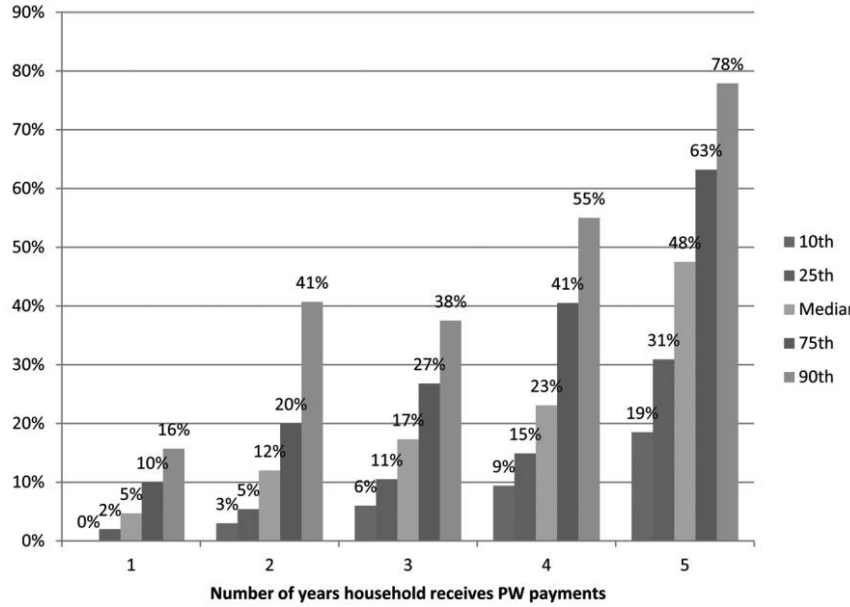

Figure 2. Distribution of payments expressed as a percentage of entitlement, by number of years households received Public Works payments.

Works payments, the higher the receipt of annual payments, the higher the average payment per year, the higher the total payment received, and the greater the percentage of your entitlement that was received. For these reasons, we use number of years of receipt of Public Works payments as the dose measure.

D. Contexts

Like the rest of the world, Ethiopia also experienced a dramatic rise in food prices in 2007–8. This had implications for purchasing power of wages as well as food security among households that are net buyers of food. In localities included in our study, there were significant increases in food prices in 2006–8, with further increases, although smaller in magnitude, between 2008 and 2010. The consumer price data collected as part of the community survey show marked rises in the price of staples, but the magnitude of these increases differs by region and crop. For example, between 2006 and 2010, maize prices rose by 78% in SNNPR (the most densely populated region included in the PSNP and the region with the most extensive road network) and by 160% in Oromiya, the region where PSNP beneficiaries typically had poor market access.

Covariate and idiosyncratic shocks are a fact of life in rural Ethiopia; Dercon, Hoddinott, and Woldehanna (2005) show that these have pernicious

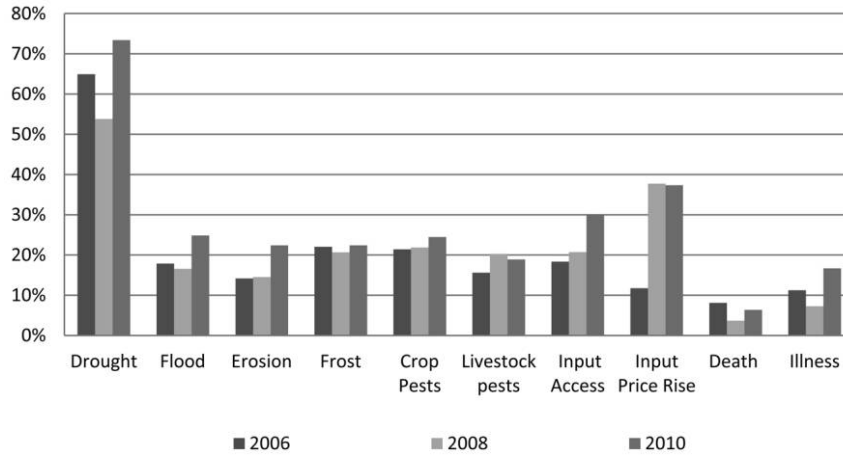

Figure 3. Incidence of shocks, 2006–10

effects on livelihoods and so, in figure 3, we describe their incidence between 2006 and 2010.[12] Drought shocks are frequently reported but so, too, are other climatic shocks such as frosts and flooding. Also striking is the increase in the reporting of input shocks. Across all shocks described in figure 3, there is no evidence of their diminution over time, and they are more frequently reported in 2010 than they were in 2006.

Rising food prices, falling (in real terms) asset prices, widespread drought shocks, and increasing difficulties in accessing inputs hardly make for a benign environment. The government of Ethiopia defines the "super goal" of the PSNP as being the reduction in the food gap. In the 2006, 2008, and 2010 surveys, households reported the number of months, out of the preceding 12 months, that they had "no problems satisfying the food needs of the household." Table 4 shows the evolution of this outcome over time for participants in the Public Works component of the PSNP disaggregated by number of years of participation. Prior to the introduction of the PSNP, beneficiary households reported, on average, 8.36 months of food security. The unconditional mean improved slightly after the PSNP's introduction, but given the increase in food prices, unsurprisingly stagnated between 2006 and 2008 before rising between 2008 and 2010. There are marked differences in these unconditional means, with the greatest improvement found among beneficiaries who received 5 years of payments.

[12] Specifically, respondents were asked to identify events that led to a serious reduction in their asset holdings, caused household income to fall substantially, or resulted in a significant reduction in consumption.

TABLE 4

MEAN MONTHS OF FOOD SECURITY, BY YEAR AND YEARS RECEIVING PUBLIC WORKS PAYMENTS

	Number of Years Household Received Public Works Payments					
Months of Food Security	1	2	3	4	5	All
2004	8.76	8.58	8.24	8.16	8.25	8.36 (2.68)
			PSNP begins in 2005			
2006	8.96	8.67	8.50	8.65	8.23	8.52 (2.65)
2008	8.62	9.07	8.99	8.81	8.00	8.53 (2.29)
2010	8.61	9.34	8.56	8.85	8.95	8.87 (2.72)
Change, 2006 to 2010	−.35	.67	.06	.20	.72	.34 (3.13)

Source. Household survey.
Note. Standard deviations in parentheses. PSNP = Productive Safety Net Programme.

TABLE 5

MEAN LIVESTOCK UNITS, BY YEAR AND YEARS RECEIVING PUBLIC WORKS PAYMENTS

	Number of Years Household Received Public Works Payments					
TLU	1	2	3	4	5	All
2004	4.31	4.51	3.50	3.57	2.42	3.38 (4.34)
			PSNP begins in 2005			
2006	4.65	4.47	3.68	3.55	3.03	3.67 (3.24)
2008	3.63	4.28	3.89	3.45	2.87	3.44 (3.68)
2010	4.26	4.62	3.91	3.83	3.40	3.86 (3.34)
Change, 2006 to 2010	−.38	.14	.23	.27	.37	.18 (2.78)

Source. Household survey.
Note. Standard deviations in parentheses. TLU = tropical livestock unit. PSNP = Productive Safety Net Programme.

Households were also asked about their livestock holdings. Since livestock are the principle means by which households in these localities can accumulate wealth, these data provide a good indication of whether the PSNP is meeting its goal of reducing asset depletion and whether the PSNP and OFSP/HABP are jointly contributing to asset accumulation. Livestock holdings are measured in tropical livestock units (TLU).[13] Table 5 shows the evolution of livestock holdings of Public Works participants over time. These were 3.38 TLU in 2004 and 3.67 TLU in 2006. They declined between 2006 and 2008 before rising to 3.86 in 2010. Again the largest increase in the unconditional mean is found among beneficiaries receiving transfers for 5 years.

[13] A TLU equals 1 for cattle, horse, and mules, 0.15 for sheep and goats, 0.005 for poultry, 0.65 for donkeys, and 1.45 for camels (Ramakrishna and Demeke 2002).

IV. The Impact of Payments for Public Works: 2006–10

Table 6 shows dose-response estimates for different years of receipt of Public Works payments on changes in the number of months that the household reports that it can meet its food needs between 2006 and 2010. These show that predicted increases in months of food security rise as the number of years of Public Works participation rises. A Public Works household that receives payments for 3 years has a 0.22 improvement in months of food security. A household getting 5 years of payments shows a 0.95 month gain in food security.

Recall from tables 2 and 3 and figure 2 that households that received only 1 year of PW payments in practice received next to nothing: the median transfer level over 5 years was only 186 birr, and such households received only 5% of their entitlement. By contrast, median transfers to households receiving payments in all 5 years were 3,370 birr, equivalent to 48% of their entitlement. Given these stark differences in transfer levels, and given that the median transfer to households receiving only 1 year of PW payments is so low, getting transfers for only 1 year is effectively the same as getting no transfers. But because these households were selected for the PSNP, they provide an excellent counterfactual for those who received payments for multiple years. The double difference estimate of impact for, say, receiving 5 years of payments compared to 1 year is the difference between the 5-year impact estimate (0.951) and the 1-year impact estimate (−0.337). This equals 1.288 months (0.951 − (−0.337)). We construct a *t*-test statistic for this difference, which has a value of 5.50. This tells us that the impact of 5 years of Public Works payments, compared to receiving (virtually) nothing, is to increase household food

TABLE 6

DOSE-RESPONSE ESTIMATES OF IMPACT ON CHANGE IN FOOD SECURITY (MONTHS) OF YEARS RECEIVING PUBLIC WORKS PAYMENTS

Number of Years Household Received Public Works Payments	Full Sample			Beneficiaries from 2006 Onward		
	Predicted Change	SE	*t*-Statistic	Predicted Change	SE	*t*-Statistic
1	−.337	.210	−1.60	−.510	.261	−1.95
2	.284	.148	1.92	.357	.157	2.28
3	.221	.151	1.47	.433	.179	2.42
4	.104	.144	.72	.324	.170	1.91
5	.951	.137	6.94	1.059	.181	5.86
Difference between 5 years and 1 year	1.288	.234	5.50	1.569	.324	4.84

Source. Calculated from household survey.

Note. Sample size is 1,510 for full sample and 801 for sample of beneficiaries from 2006 onward.

security by 1.288 months. This is equivalent to reducing the length of the hungry season, which was 3.64 months, on average, in 2004 by more than one-third.[14]

These results build on the evidence provided in Gilligan et al. (2009), which estimated the impact of the PSNP on household welfare, asset ownership, and agricultural and economic activity in 2006, after the first year of the project. That paper showed weak impacts of the PSNP alone in its first year, due in part to substantial delays and underpayment of transfers, although households receiving the PSNP and the OFSP benefited from impacts on food security and several measures of enhanced economic activity. The impact estimates based on participation dosage models presented here show the impact of more intensive involvement in the PSNP from 2006 to 2010. These estimates may somewhat underestimate the overall impact of the PSNP to the extent that the welfare of beneficiaries had already improved as a result of the program from 2005 to 2006. With the caveat that our information on pre-2006 participation is incomplete, we reestimate the dose-response model restricting the sample to beneficiaries who we believe entered the PSNP from January 2006 onward. These results are shown in the right-hand panel of table 6. This shows a somewhat larger estimate of impact, 1.569 months.

A limitation of the food gap measure is that it is subjective. The household survey collects data on quantities of food consumed in the 7 days prior to the interview, and we use these data to construct a measure of caloric availability at the household level for 2006 and 2010. However, despite numerous attempts using a variety of dose-response model specifications, we find no evidence of improvement in this outcome. Earlier evaluations of the PSNP (see Gilligan et al. 2009) noted that this outcome was highly sensitive to the receipt of payments in the months leading up to survey. As discussed extensively in Berhane et al. (2011), there were widespread payment delays in 2010. Figure 4 illustrates this, showing between 2006 and 2010, a dramatic decline in the proportion of PSNP beneficiaries receiving payments in the 3 months—March, April, and May—prior to the survey. We suspect that this decline is the cause of our failure to find an impact on this outcome.

Another possible reason why we could not find significant effects relates to measurement error. Calculating caloric availability at the household level requires respondents to accurately recall quantities of food consumed over the

[14] As a robustness check, we constructed two falsification tests using an outcome variable that was determined prior to the start of the PSNP, whether the father of the household head was considered a respected man in the local community and household size prior to the start of the PSNP. We find no evidence that duration of participation affected either outcome.

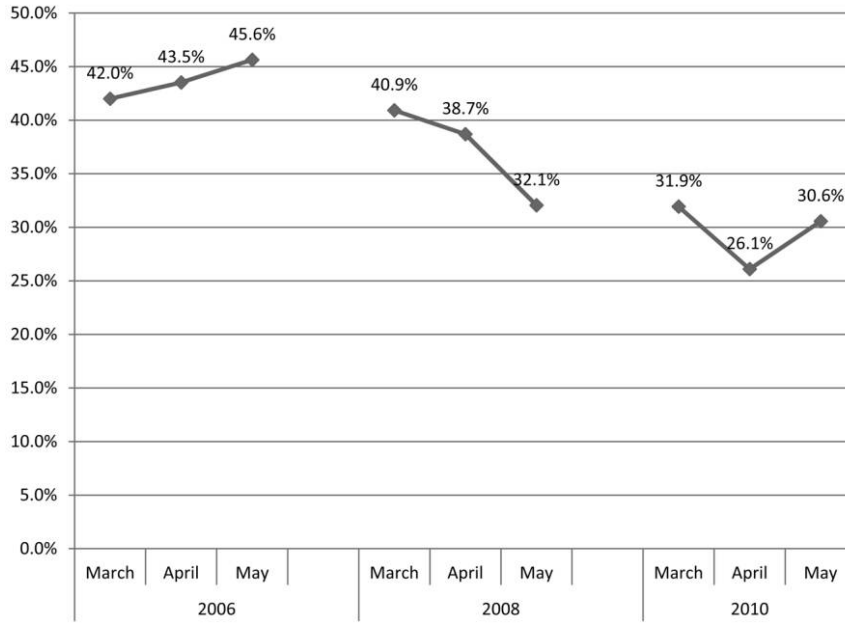

Figure 4. Percentage of Public Works participants receiving payments in March, April, and May, 2006, 2008, and 2010.

last 7 days and the units in which these were consumed. Not only is there scope for recall error, but respondents often use nonstandard measures including *tassa*, bottles, bunches, pieces, and *small madaberia*. Errors in the conversions of these to kilograms and liters will also create measurement error in calories. One way of addressing this problem is to look at the number of different foods that a household reports consuming in the last 7 days. This is less subject to measurement error and is a valid and desirable food security outcome in its own right (Hoddinott and Yohannes 2002). However, when we construct dose-response estimates for the change in dietary diversity between 2006 and 2010, we find no evidence of differential impacts between households receiving 1 and 5 years of Public Works employment. This suggests that the relatively low percentage of households receiving transfers in the months prior to the survey, and not measurement error, is the reason why we cannot find an impact on changes in caloric availability at the household level.

Has the PSNP enabled beneficiaries to maintain or even increase their asset holdings? Table 7 shows dose-response estimates of predicted changes in livestock (TLU) holdings. Households receiving 4 or 5 years of payments have predicted increases of 0.340 and 0.386 TLU, respectively. The double difference estimate of impact, the difference between outcomes after 5 years and

TABLE 7

DOSE-RESPONSE ESTIMATES OF IMPACT ON CHANGE IN LIVESTOCK HOLDINGS (TLU) OF YEARS RECEIVING PUBLIC WORKS PAYMENTS

Number of Years Household Received Public Works Payments	Full Sample			Beneficiaries from 2006 Onward		
	Predicted Change	SE	*t*-Statistic	Predicted Change	SE	*t*-Statistic
1	−.011	.170	−.06	.053	.266	.20
2	−.157	.126	−1.25	−.041	.191	−.21
3	.007	.124	.06	.267	.172	1.55
4	.340	.100	3.38	.606	.105	5.79
5	.386	.097	3.98	.452	.170	2.66
Difference between 5 years and 1 year	.397	.238	1.66	.377	.329	1.15

Source. Calculated from household survey.
Note. Sample size is 1,503 for full sample and 794 for sample of beneficiaries from 2006 onward. TLU = tropical livestock unit.

1 year, is 0.397 and is significant at the 10% level. We also examined whether the PSNP led to increases in holdings of tools and other capital assets. Households receiving payments for 5 years saw an increase in their holdings of these tools by 221 birr. However, a change of comparable magnitude is seen across all beneficiary households irrespective of the number of years the household received Public Works payments, and, as a result, the double difference impact is not statistically significant.

Last, we note that a persistent concern with social safety net interventions is that they reduce, or crowd out, informal social safety nets such as private transfers. Further, they may provide a disincentive for households to engage in new income-generating activities such as starting nonfarm own businesses. We examine the impact of duration of Public Works participation on changes in net private transfers where net private transfers is the difference between transfers received from other households and those given to other households in the previous 12 months. Both cash and the value of in-kind transfers are included in this measure, and we deflate net transfers received in 2010 by Ethiopia's Consumer Price Index to take inflation into account. In this sample, these are typically small; mean net transfers in 2006 were only 12 birr. We find no evidence of crowding out of private transfers; in fact, there is a small—but not statistically significant—increase. We also find no evidence that longer participation reduces the likelihood of entering into nonfarm own business activities (results available on request).

We explored whether, at the margin, program impacts increased or decreased with greater duration of program participation. We do not find systematic evidence. For the full sample, at the margin, impacts increase with

longer program participation (e.g., the impact of going from 3 to 5 years participation is larger than going from 1 to 3 years). However, if we restrict the sample to beneficiaries who we believe entered the PSNP from January 2006 onward, impacts diminish at the margin.

V. The Joint Impact of Payments for Public Works and the Other Food Security and Household Asset Building Programs: 2006–10

We now consider the joint impact of the PSNP and access to the OFSP or HABP on dimensions of food security and asset holdings. We define "access" as follows. A household has had access to the OFSP or HABP if, in the 2006 or 2008 survey, it reported access to the OFSP in 2006, 2007, or 2008 or if in the 2010 survey it reported access to the HABP. Access to the OFSP is defined as receiving advice or assistance on improved seeds, tools, irrigation, poultry or livestock, beekeeping, soil and water conservation, or credit. Access to the HABP is defined in terms of whether a household had contact with a DA, either individually or in groups. Approximately three-quarters of Public Works beneficiaries report access to the OFSP or HABP between 2006 and 2010.

Recall that households that received only 1 year of PW payments in practice received next to nothing—the median transfer level over 5 years was only 186 birr. Median transfers to households receiving payments in all 5 years were 3,370 birr, equivalent to 48% of their entitlement. Given these stark differences in transfer levels, and given that the median transfer to households receiving only 1 year of PW payments is so low, here we describe those getting transfers in 1 year as "No PSNP" (row 1 of table 1), while those receiving payments for 5 years are called "PSNP" households (row 2 of table 1). Similarly, we distinguish between households that did not have access to OFSP/HABP transfers (col. 1 of table 1) and those with access to OFSP/HABP transfers (col. 2 of table 1). This provides us with four categories of beneficiary status with respect to the PSNP and OFSP/HABP.

By calculating the differences across these categories, we can estimate the separate impacts of the PSNP and the OFSP/HABP. For example, the difference between categories A and D captures the joint impact of the OFSP/HABP and the PSNP relative to receiving neither. Comparing B with D gives the additional impact of the OFSP/HABP on households that received the PSNP. These calculations are reported in table 8. Relative to having no program benefits, having the PSNP and OFSP/HABP increases food security by 1.505 months; for households receiving the PSNP, the OFSP/HABP provides an increase in food security of 0.818 months. We also consider impacts on livestock holdings. Table 9 shows that households receiving both PW pay-

TABLE 8

IMPACT OF THE PSNP AND THE OFSP/HABP ON MONTHS OF HOUSEHOLD FOOD SECURITY

Difference Between	Category	Dose Response	Category	Dose Response	Impact (Difference in Months)	*t*-Statistic on Difference
D and A	D: PSNP, OFSP/HABP	1.042	A: No PSNP, No OFSP/HABP	−.463	D − A = 1.505	3.67***
D and B	D: PSNP, OFSP/HABP	1.042	B: PSNP, No OFSP/HABP	.224	D − B = .818	2.50**

Source. Calculated from household survey.
Note. PSNP = Productive Safety Net Programme; OFSP = Other Food Security Programme; HABP = Household Assets Building Program.
** Significant at the 5% level.
*** Significant at the 1% level.

TABLE 9

IMPACT OF THE PSNP AND THE OFSP/HABP ON LIVESTOCK (TLU)

Difference Between	Category	Dose Response	Category	Dose Response	Impact (Difference in TLU)	*t*-Statistic on Difference
D and A	D: PSNP, OFSP/HABP	.372	A: No PSNP, No OFSP/HABP	−.628	D − A = .999	3.16***
D and B	D: PSNP, OFSP/HABP	.372	B: PSNP, No OFSP/HABP	.320	D − B = .052	.198

Source. Calculated from household survey.
Note. TLU = tropical livestock unit. PSNP = Productive Safety Net Programme; OFSP = Other Food Security Programme; HABP = Household Assets Building Program.
** Significant at the 5% level.
*** Significant at the 1% level.

ments and OFSP/HABP accumulated 0.999 TLU more than households that received neither.

VI. Summary

This study considers the impact of the duration of participation in the Public Works component of the PSNP. We note that households who received payments for 1 year typically received only tiny amounts—the median total Public Works payment for such households over a 5-year period is only 186 birr. Our impact estimates match these households to those receiving 2, 3, 4, or 5 years of transfers. Taking the difference between the impact estimate of a change in an outcome for a household receiving, say, 5 years of payments, and the impact estimate of a change in an outcome for a household receiving 1 year of payments yields our double-difference estimate of program impact. Against the formidable background of rising food prices and widespread drought, participation in the Public Works component of the PSNP has modest effects. The

PSNP has improved food security by 1.29 months. This impact is statistically significant and is equivalent to reducing the length of the hungry season by one-third. Five years of participation raises livestock holdings by 0.38 TLU relative to receipt of payments in only 1 year. There is no evidence that the PSNP crowds out private transfers, although in this sample these are typically small. The joint impact of access to both the PSNP and the OFSP/HABP is larger than access to only one program. Having both the PSNP and OFSP/HABP increased food security by 1.5 months and livestock holdings by 0.99 TLU.

Our evaluation has weaknesses. We apply continuous matching methods to calculate difference-in-difference estimates of impact, within and across beneficiary samples. As is well known, this approach cannot account for time-varying unobservables, and we cannot rule out the possibility that their existence biases our results. We cannot distinguish between the impact of duration of program participation from the level of transfers received. The timing of the surveys was not ideal; it would have been much better had the first survey been fielded prior to the implementation of the PSNP. Finally, the sample design precludes measuring important outcomes relating to the impact of the community assets on both PW participants and nonparticipants.

With these caveats in mind, these results point toward several conclusions. First, Ethiopia's experience suggests that it is indeed possible to implement a large-scale social safety net with measurable impacts in an environment characterized by limited infrastructure and administrative resources. Second, impacts were larger when safety net transfers were combined with access to services designed to improve agricultural productivity. Third, at least in these data, there is little evidence of the safety net having disincentive effects, an oft-raised concern.

Appendix

TABLE A1

MAXIMUM LIKELIHOOD ESTIMATE OF GENERALIZED PROPENSITY SCORE, PSNP SAMPLE

	β	SE	*Z*-Statistic
Demographic characteristics:			
Age of household head	−.012	.002	−4.34***
Household head is female	−.134	.101	−1.33
Grades of schooling, head	.006	.007	.79
Household size	.062	.019	3.26***
Wealth:			
Land holdings (hectare)	.039	.036	1.06
Number of oxen	−.210	.039	−5.28***
Head born in this location	.053	.106	.50
Preintervention food security:			
Months of food security, 2004	−.021	.015	−1.40

TABLE A1 (*Continued*)

	β	SE	*Z*-Statistic
Household experienced . . . shock in . . .:			
Drought, 2004	.120	.088	1.36
Drought, 2005	−.015	.093	−.16
Drought, 2007	.132	.085	1.54
Drought, 2008	−.017	.118	−.15
Drought, 2010	−.087	.102	−.85
Head ill, 2004	.218	.359	.61
Head ill, 2005	.459	.369	1.25
Head ill, 2006	−.502	.406	−1.24
Head ill, 2007	−.447	.317	−1.41
Head ill, 2008	.337	.341	.99
Head ill, 2009	−.221	.215	−1.03
Head ill, 2010	.201	.254	.79
Spouse ill, 2005	.293	.367	.80
Spouse ill, 2006	−.115	.354	−.33
Spouse ill, 2007	−.002	.291	−.01
Spouse ill, 2008	.274	.297	.92
Spouse ill, 2009	−.249	.312	−.80
Spouse ill, 2010	−.318	.216	−1.47
Spouse ill, 2005	.017	.226	.08
Woreda shocks:			
Percent household reporting drought shock, 2004	−.009	.002	−4.02***
Percent household reporting drought shock, 2005	.006	.002	2.72***
Percent household reporting drought shock, 2008	.003	.002	1.75*
Percent household reporting drought shock, 2010	.002	.002	1.05
Ratio, cattle prices 2010 2006	−.171	.072	−2.36**
Ratio, staple grain prices 2010 2006	−.040	.040	−1.00
Constant	4.457	.351	12.69

Note. Missing shock years are those where variable did not balance.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

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