FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

HONDURAS

Feed the Future Zone of Influence Baseline Report

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USAID
FROM THE AMERICAN PEOPLE

IFPRI
INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE
sustainable solutions for ending hunger and poverty
Supported by the CGIAR

Evaluation of Feed the Future Intervention

ACCESO-Honduras

Baseline Results

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1 Introduction and Project Background

USAID-ACCESO (henceforth referred to as 'ACCESO') is a four-year project funded by the USAID Office of Economic Growth in Honduras, aimed at increasing household income to directly lift 30,000 beneficiary households out of poverty, of which 18,000 from extreme poverty[2], and to decrease under-nutrition in these households. The project represents the core investment by USAID-Honduras in the U.S. Government's (USG) Global Hunger and Food Security Initiative known as the Feed the Future Initiative (FTF). The project will work through components that enable economic development at the household level. These are:

1. Agricultural and value-added technical assistance and training to enhance the capacity of Honduras's poorest households in production, management and marketing skills
2. Facilitating market access by focusing on developing linkages of farmers to market opportunities
3. Increasing the availability of rural financial services through existing intermediaries, village banks, commercial banks, and other service and input providers
4. Assisting in the elimination of policy barriers that are impeding rural households' access to market opportunities
5. Dietary diversification and malnutrition prevention activities to enhance the capacity of rural households to improve utilization and consumption of food
6. Sound environmental and natural resource management.

ACCESO targets six departments in Honduras that are amongst the poorest in the country: Copán, Santa Bárbara, Ocotepeque, Lempira, Intibucá, and La Paz. The majority of farm households cultivate traditional crops on small plots, often on hillsides. Their access to markets is hindered by poor roads and long distances. The use of traditional cultural practices produces poor yields, depletes soil of nutrients, and leads to forest encroachment.

[2] Households are considered to live in *extreme* poverty if their income is not sufficient to cover the cost per-capita of the basic ***food* bundle**. The **basic bundle** is the ***food* bundl**e expanded by the Engels factor. In this case is 2 for urban areas and 1.33 for rural households. The rural poverty line is: Extreme 1,082.9 Lps. Person/Month ($1.91 Person/day) and relative 1,445.6 Person/Month ($2.55 Person/day) (SOURCE)

Agricultural technical assistance and training target basic grain producers. Technicians assist producers in changing traditional production practices by introducing: soil preparation practices; increasing planting densities; implementing weed control; improving fertilization use, safe and correct use of pesticides and record keeping; and by providing farm certification options and postharvest handling. These basic practices and associated skills can increase productivity, reduce the risks of climate-related losses, and serve as a starting point for diversification to more profitable crops. Providing basic grain producers with low- or no-cost technologies enables them to increase yields and reduce production and postharvest losses. This will benefit a large number of rural households, helping them meet their subsistence needs, reduce outside expenditures, and provide some supplemental income through surplus sales.

In addition, collaboration to increase access to new technologies is part of the activities in ACCESO. Alliances with private companies that distribute irrigation equipment, other agricultural equipment, clean energy production equipment, or promote health, natural resource management and disaster mitigation complement assistance across ACCESO's agricultural and nutrition themes[3].

Value-added training topics include: cost structure development, equipment recommendation, promoting good manufacturing practices, legal issues, new market contacts, suppliers for packaging materials, and improvements in processing techniques to reduce the cost of production and increase efficiencies.

The key source of credit need among farmers is for the purchase of inputs prior to planting and during production. Farmers often demand input amounts that are smaller than the quantity in which they are sold, which makes it more difficult for them to get access to the appropriate inputs. ACCESO facilitates cooperation between input suppliers and community banks to address credit constraints that prevent farmers from accessing these necessary inputs through group buying schemes. These are directed by the community banks, to which farmers have a post-harvest liability.

[3] Some examples are: ecological coffee processing equipment, corn mills, water storage equipment, food processing equipment.

The health and nutritional initiatives of ACCESO are directed at women and children as a way to better affect the overall nutritional status and habits of the household. The main activities under this component are:

1. The promotion and improvement of breast-feeding practices through female support groups during and after pregnancies. Breast milk has a high caloric content and strengthens the immune system of children, which prevents undernourishment and reduces infant mortality.
2. The promotion and improvement of feeding practices for children less than 2 years of age, pregnant women, and lactating women in beneficiary households. This intervention targets the period where problems of stunted growth and undernourishment can prevent the development of children's initial endowments affecting them for the rest of their lives. The aim of this aspect is to integrate children into the family diet smoothly with breast-feeding and other high-nutrient food products acting as complement during the transition period.
3. The introduction and support of production of high-nutrient fruits and vegetables produced both commercially and within kitchen gardens, to increase the diversity of foods available to households and communities.
4. The promotion of appropriate use of latrines to improve sanitation and reduce contamination of water sources, which aims at preventing nutrient draining illnesses like diarrhea.
5. The introduction of fuel-efficient wood burning stoves which will decrease level of indoor pollution, and hence the incidence of pneumonia and death for children under five.

The environmental resource management of ACCESO includes the development of community water infrastructure and water source protection. Protecting water sources from contamination is complementary to both the agricultural and health activities under ACCESO and includes the promotion of better water management practices, better water quality monitoring, reduced pesticide and fertilizer use and decreased soil erosion through planting live barriers.

As can be seen from this brief description of the initiatives under ACCESO, there are many interlinked activities, and hence many intermediate and final indicators that need to be monitored to gauge the impact and effectiveness of the program. In what follows we present the results of the baseline survey conducted in June-July 2012 to measurement the key indicators

and outcomes in the FTF results framework and evaluate the impact of the intervention on the economic wellbeing of the households in the zone of influence.

2 Impact Evaluation Methodology

In order to discuss the main approach, as well as some subsequent issues, it makes sense to think of evaluation in a standard regression framework. Suppose we observe some outcome of interest Y and we want to measure the impact of participating in ACCESO on this variable. We denote participation in ACCESO using the indicator variable T for treatment. Specifically, $T = 1$ if a household participated in ACCESO and $T = 0$ if they did not. To get the average impact of the program, we can run a regression of Y on T, i.e. we can estimate the following equation:

$$Y_{it} = \beta_0 + \beta_T T + \delta(X_{it}) + \varepsilon_{it} \quad (1)$$

where i indicated the household and t indicates the time period, Y_{it} is the outcome of interest, X_{it} are covariates, $\delta(.)$ is some function, ε_{it} is a random error term.

We could estimate this regression immediately if there were no evaluation problem. However, there *is* an evaluation problem in the sense that we can only observe household i in either status $T = 1$ or status $T = 0$ at any given point in time t, but not in both. Put another way, we would like to be able to see what would have happened to a given household if their treatment status had been different. Hence in order to assess the impact of the program, we need a valid counterfactual group[4].

We propose to use a combination of methods to obtain valid inferences about the household level impacts of the activities under ACCESO. These include selecting our samples of beneficiaries and non-beneficiaries to be as similar as possible in terms of their observable characteristics prior to the program. The framework serving as a guideline for our empirical analysis is the Roy-Rubin model [Roy (1951) Rubin (1974) Rubin (1977) Rubin (1979) Rosenbaum and Rubin (1983)]. Once

[4] Todd (2008) is an excellent overview of the evaluation 'problem' and the methods designed to overcome it.

propensity scores (predicted probabilities) have been computed for each of the households in the first survey sample, these scores will be used to select pairs of beneficiary and non-beneficiary households that are as similar as possible in terms of their probability of being selected into the program. Information on characteristics of potential survey households before the program is obtained from the baseline survey and the main variables are described in this report.

Matching represents a credible non-experimental option for identifying comparison groups. We use propensity score matching (PSM) [Dehejia and Wahba (1994) Rosenbaum and Rubin (1983) Heckman, Ichimura, and Todd (1997) Heckman, Ichimura, and Todd (1998) Heckman et al. (1998)] to ensure that treatment recipients are compared to non-recipients who are similar in terms of observable household characteristics; however, there still may be other observable and unobservable differences between recipients and non-recipients that could bias the results. For example, the quality (unobservable) and tenure of the plots used by beneficiaries may differ from that of the non-beneficiaries, and such information may not be available or usable for the propensity score matching and sample selection. To account for this, these types of observable information will be added in the baseline surveys, and controlled for in the econometric analysis. Other explanatory variables collected in this survey will include: household endowments of physical, human, natural, financial, and social capital; household access to information, markets, and services; and other factors influencing households' livelihood options and outcomes.

Even after controlling for such observable differences, there may be differences in unobservable characteristics of recipients and non-recipients which could also bias the results (called 'selection on unobservables' in the literature Heckman et al. (1998). Two methods will be used to address this problem. First, some of the relevant unobservables may be relatively similar across households within a village (e.g., weather). Inclusion of village-level fixed effects in the econometric estimation can help to reduce any bias caused by such unobserved factors Pitt and Kandker (1998.).

Second, the double-difference (DD) estimator, which considers the difference between program participants and non-participants in changes in outcomes before and after the program, will be used (this can be implemented in combination with an econometric approach controlling for

differences between the beneficiaries and non-beneficiaries Ravallion (2008)). Since we will have panel data collected, this method can be used based on differences in outcomes between the baseline and the follow up survey. This approach removes the effects of any unobserved fixed factors that differ between participants and non-participants, if those have a linear additive impact on outcomes (e.g., differences in abilities). However, these results may be confounded by other changes between the time of the baseline and the follow up surveys, besides the intervention program influencing changes in outcomes differentially between participants and non-participants (e.g., changes in access to other programs). Changes in such other factors will be accounted for to the extent possible. However, some biases may persist, caused by changing unobserved factors that differ between program beneficiaries and non-beneficiaries within villages (e.g., access to information).

We explore below how this problem can be mitigated if a regression discontinuity design is applicable and/or when a randomized component can be included, for example with regard to the area of improved access to information through ICT.

2.1 Propensity Score Matching

As mentioned above, in this method the selection of a control unit for a given beneficiary is done according to the 'propensity score' or the probability that a given unit participates in the program given certain observable characteristics, Z. Thus, the propensity score is given by the probability that a unit is treated conditional on having observed the set of characteristics, Z- that is $P(T = 1|Z)$.

The PSM procedure allows us to select a control unit j that is very similar to a treatment unit i in all observable aspects except for treatment status, thus providing an appropriate counterfactual of the situation of i without the treatment. According to the PSM method j should be selected such that its probability of participation in the program is as similar as possible to beneficiary i's participation probability. This ensures that the observables Z are also similar and we can proceed

under the assumption that after the procedure the unobservable characteristics are also similar across the units.[5]

Intuitively, PSM creates the observational analogue of a randomized control group in which control units and beneficiary units have the same probability of participation and similar characteristics. A common practice is to use the predicted values from a logit or probit regression to estimate the "propensity score" for each observation in the beneficiary group and the non-beneficiary sample available. Namely,

$$P(T = 1|Z) = \Phi(Z\hat{\alpha})$$

(2)

where the function $\Phi(.)$ is the cumulative normal distribution (probit) or the logistic distribution (logit) and $\hat{\alpha}$ represent the estimated coefficients.

A key aspect of the PSM procedure will be the observable characteristics contained in Z. These variables (sometimes also referred to as 'matching variables') will affect the propensity score and therefore, who ends up in the control group. In the case of ACCESO, the set of matching variables Z comprise:

1) Measures of access to markets : Large cities and smaller cities with active markets
2) Poverty classification of the residence area
3) Household poverty measure at baseline
4) Nutritional status of household members, including the presence of undernourished children and women
5) Geographical indicators for departments area under corn, beans and coffee production

These should serve as good primary predictors of which households or communities are likely to be targeted. First, they are not affected by the treatment at baseline. Second, they correspond

[5] In addition, if one is not willing to make this assumption one could complement the PSM procedure with double difference methods, thus adjusting for unobservable characteristics that might differ across groups but are time invariant. This is what will ultimately be done to evaluate the impact of ACCESO as delineated in the impact evaluation design report. Here we focus on the concepts needed to understand the tests of baseline differences and briefly present the double difference method with equation (5).

to the criteria set forth by FTF and reflect the limitations that the implementers might have had when selecting the beneficiaries of the program. To the extent that access to markets and the characteristics of the distribution of household income (at baseline) are the primary criteria, we do not expect this to affect the results of the impact evaluation.

Once we have calculated the propensity score $P(T = 1|Z)$ using the best matching variables available in the survey, we can use it to assign an appropriate control group to the sample of beneficiaries (below we discuss how we plan to sample from ACCESO beneficiaries and `potential' controls). We can then use the outcome variable of interest Y for the sample of beneficiaries and matched controls to gauge the success of the propensity score matching by testing for differences in the outcome variables. In principle, there should be few differences between the matched samples if the propensity score was successful in constructing the counterfactual. The hypotheses tests take the following form:

$$H_0: \quad \frac{1}{\mathrm{n}_{It}} \sum_{\mathrm{i}} \left[\mathrm{Y}_{it}^{T} - \sum_{j} W\left(P_i, P_j\right) Y_{jt}^{C} \right] = 0$$

(3)

Where:

n_{It} is the number of ACCESO participants in the sample

Y_{it}^{T} is the variable of interest for the treatment household i at time t

Y_{it}^{C} is the variable of interest for the control(s) household j at time t

P_i is the propensity score of observation i

$W(.)$ is a function that determines the weights of each observation in the control group[6],

and the alternative hypothesis is that the difference is statistically different from zero (two-sided test). In its simplest case this function selects the "nearest" neighbor, in which case the function is an indicator of what observation *j* is the nearest to observation *i.*

[6] We note that we are not explicitly addressing the common support assumption in the discussion; just note that the distribution of variables across treatment group and control pool should have and overlap. The reader should assume that the *i* observations run through the common support region, and that the observations *j* run through the full set of controls.

$$W(P_i, P_j) = I\{\|P_i - P_j\| = \min_j \|P_i - Pj\|\}$$

(4)

Finally, to address selection into the treatment, (i.e. individuals that expect to benefit the most are more likely to participate) and rid the impact estimates of any time invariant unobservable characteristics that might confound the estimated impact; improve the precision of our estimates and address the mentioned selection we will use the difference-in-difference or double difference of the estimator. Namely,

$$\widehat{\Delta}^{DiD}{}_{Ytt'} = \frac{1}{n_{It}} \sum_i \left[(Y_{it}^T - Y_{it'}^T) - \sum_j W(P_i, P_j)(Y_{jt}^C - (Y_{jt'}^C) \right]$$

(5)

Where $t > t'$ and all other variables are defined as above.

2.2 Validity of the Assumptions

The main assumptions of the PSM methodology use assumptions from Heckman, Ichimura, and Todd (1998) :

(1) Conditional on a set of covariates or conditional on the propensity score treatment status is mean independent of the outcome of interest[7],

$$E[Y_0|P(Z), T = 1] = E[Y_0|P(Z), T = 0] = E[Y_0|P(Z)]$$

(2) The propensity score is bounded away from one, to allow us to find appropriate matches. This is essentially the 'common support' requirement.

$$P(T = 1|Z) < 1$$

[7] Note that the independence is sufficient for the non-treated potential outcome and that the propensity score is allowed to take the value of zero (weak ignorability). This is true when we are interested in the effect of treatment on the treated. If we are also interested on the treatment effect for the untreated we need a strong ignorability assumption.

In this baseline report we gauge the success of the propensity score matching using balancing tests across a wide range of variables. In addition, we identify some variables which have significant differences at baseline and which will need to be adjusted when estimating the program impacts using econometric analysis in order to parse out these differences before constructing the difference-in-difference estimate.

2.3 Outcome/indicator variables

The following data will primarily be collected by means of detailed base line, follow-up and end line survey questions in order to comply with the indicator/outcome and impact analyses set forth in the FTF documents and the expected results delineated in the ACCESO proposal (note that some indicators have been grouped by conceptual similarity, but they are derived directly from the PMP):

1) **Per capita income (as proxied by expenditures) and prevalence of poverty:** Primarily using data on (on and off-farm) income generating activities and transfers and/or expenditure data, we will be able to assess the per capita income as well as the prevalence of poverty (such as percent of people living on less than $1.25/day) among ACCESO beneficiaries. We will measure household expenditure as a proxy for income[8] ; however, there is enough detail in our survey instrument to be able to calculate an income measure that is comparable to that provided by Fintrac. In addition, as this measure reflects income from productive activities, in particular agriculture and revenue from sales we can calculate direct effect on this category of income.
2) **Prevalence of stunted children less than five years of age.** We will calculate the percent of stunted children for ages 0-60 months and by gender, where stunting is defined as percent of children falling below -2 standard deviations for height-for-age[9].
3) **Prevalence of underweight children less than five years of age.** Percent of underweight children in specified age groupings such as 12-24 months 36-59 months and by gender where

[8] See Deaton and Zaidi (1999)for a discussion of the advantages of using household expenditure as a measure of household welfare

[9] Acceso expects that malnutrition in general, i.e. prevalence of wasting and stunting, will decrease by 20% of baseline levels. We present simulations later that indicate the number of children necessary to achieve this goal in Appendix B – Sample Methodology

underweight is defined as percent of children falling below -2 standard deviations for weight-for-age. Using anthropometric data collected on children, we will be able to assess prevalence of these issues in the targeted departments.

4) **Prevalence of wasted children less than five years of age.** Wasting will be measured using weight-for-height. Wasting is defined as the percent of children (6-59 months) falling below -2 standard deviations for weight-for-height.
5) **Prevalence of children 6-23 months receiving a minimum acceptable diet.** Using data on practices and types of food intake by women and young children (collected on women), we will be able to assess dietary practices, across different age groups. Minimum dietary diversity[10] will be measured as the proportion of children 6–23 months of age who receive foods from 4 or more food groups in the previous day. Also the Proportion of breastfed and non-breastfed children 6–23 months of age who receive solid, semi-solid, or soft foods (but also including milk feeds for non-breastfed children) the minimum number of times or more. And these indicators use to calculate the minimum acceptable diet as the proportion of children 6–23 months of age who are breastfed and who had at least the minimum dietary diversity and the minimum meal frequency during the previous day; and for non-breastfed children as the proportion who received at least 2 milk feedings and had at least the minimum dietary diversity not including milk feeds and the minimum meal frequency during the previous day.
6) **Prevalence of exclusive breastfeeding of children less than 6 months.** Using data on practices and types of food intake by women and young children (collected on women), we will be able to assess breastfeeding practices, across women and different age groups. We will calculate the proportion of infants 0–5 months of age who are predominantly breastfed. Other calculations include[11], duration of breastfeeding and age appropriate breast feeding.
7) **Households with moderate to severe hunger.** Using data on perceptions and respondents' experiences with hunger, we can assess prevalence of moderate to severe hunger at the household level. The Household Hunger Scale[12] is a simple measure, consisting of only three

[10] See WHO (2010)and ICF International ; Measure DHS (2012)
[11] See WHO (2010)
[12] See Ballard, Coates, and Deitchler (2011)

questions and three frequency responses; we have included additional questions that might be valid in the Honduran context and would give a more nuanced view of hunger.

8) **Household, children and women's dietary diversity:** Using data on types of food intake by women and young children (collected on women), we will be able to assess the mean number of food groups consumed by women (out of 9 food groups detailed in the FtF guidelines), specifically those of reproductive age. For children this is done as detailed in point (5).
9) **Prevalence of underweight women:** Similarly to the case of children we will collect anthropometric data to assess this prevalence measure. We will calculate the proportion of underweight non-pregnant women of reproductive age (15-49 years) defined as a body mass index (BMI) < 18.5. The BMI is calculated as the ratio of the weight (in kg) and the square of height (in meters).
10) **Women's empowerment in agriculture:** Women's Empowerment in Agriculture Index (WEI) will be applied to both the adult female and adult male of any Household. We will construct the index based on survey measures collected across the following dimensions (1) women's role in household decisions related to agriculture, (2) women's access to productive capital (such as credit or land), (3) women's abilities to feed their families an adequate diet, (4) women's access to leadership roles within the community, and (5) women's labor time allocations relative to men's.
11) **Prevalence of modern family-planning methods.** Using data on contraceptive methods knowledge and practices.
12) **Change in agricultural productivity and market discount of project-level, targeted agricultural commodities:** Using data on agricultural production, implementation of modern agricultural techniques, agricultural prices and measures of market access (possibly through farmer groups and increases in farm gate sales), we can assess levels of productivity and price differentials across the treatment and the control groups. Other indicators in this group are: share of farmers using improved seed varieties, the number of farmers able to access fertilizers, average yields for staple crops, and area under improved agricultural and natural resources practices.
13) **Prevalence of Anemia in women of age 15-49 and children under 5 year through capillary blood samples**. In partnership with nurses from the Ministry of Health hemoglobin tests will

be conducted using the finger prick procedure. The protocol for conducting these procedures is currently under review by IFPRI's Institutional Review Board. Furthermore, quotations have been requested for the necessary components. While the aforementioned nurses should be familiar with the procedures for taking these blood samples, instructions will be provided by IFPRI as well, following the procedures in the Biomarker Manual developed by ICF and Measure DHS (see references). We will calculate the percentage of women between 15-49 with any anemia, mild anemia, moderate anemia and severe anemia and adjust our estimates for altitude if necessary[13]. Similar for anemia in children.

[13] Higher altitude (above sea level) causes a generalized upward shift of the Hb distributions. This shift may be associated with the under diagnosis of anemia for residents of higher altitudes when sea-level cutoffs are applied

3 Survey Design, Geography and Treatment Assignment[14]

Table 1 shows the sample distribution in the design. In the survey design we set out to interview 3,444 households in the zone of influence (574 in each department) distributed across 162 villages. At the design stage, a household was defined as a treatment household if it was selected from the list of beneficiaries provided by the implementers. Control households were selected from the villages of treatment households and from other villages using the 2001 census as the sample frame.

TABLE 1 SAMPLE DESIGN

	Households			*PSU-Village-Aldea*		
Department	*Total*	*Controls*	*Treatment*	*Total*	*Treatment and Control*	*Control*
Copan	574	378	196	27	14	13
Intibucá	574	378	196	27	14	13
La Paz	574	378	196	27	14	13
Lempira	574	378	196	27	14	13
Ocotepeque	574	378	196	27	14	13
Santa Bárbara	574	378	196	27	14	13
Total	3444	2268	1176	162	84	78

After excluding households that did not provide consent nor had invalid geographic data, the effective sample size is 3,326 households for a total attrition of 3.4 percent. Table 2 shows the distribution of the effective sample and the attrition rates. The attrition was low, given that the we use a limited replacement list for each household selected in the sample to adjust for the houses that might have been destroyed, unoccupied, etc., since the 2001 census and for the household in the treatment list that could not be located or where multiple names from the same households were drawn during the sample selection. Note that because of this we have more treatment households than originally expected in some cases, and less in others. The largest attrition rate was in Lempira for the treatment group and in Intibucá for the control group. The attrition in the treatment group is largely due to the inability of finding the persons selected from the beneficiary list, in most cases because the geographical information was incorrect when the beneficiaries participated in meeting in central locations, such as the municipality center, etc.

[14] See Appendix B – Sample Methodology for sample design details and power analysis

TABLE 2 EFFECTIVE SAMPLE DISTRIBUTION

	Households			*Attrition*		
Department	*Controls*	*Treatment*	*Total*	*Control*	*Treatment*	*Total*
Copan	365	191	556	3.4%	2.6%	3.1%
Intibucá	344	226	570	9.0%	-	0.7%
La Paz	357	194	551	5.6%	1.0%	4.0%
Lempira	366	168	534	3.2%	14.3%	7.0%
Ocotepeque	356	187	543	5.8%	4.6%	5.4%
Santa Bárbara	364	208	572	3.7%	-	0.3%
Total	2152	1174	3326	5.1%	0.2%	3.4%

For the final treatment status assignment, households that were initially classified as control households were reclassified as treatment households if they reported receiving extension services or nutrition information from the ACCESO intervention. This explains the having more treatment households than expected in Intibucá and Santa Bárbara. However, there is an issue of attribution, as can be seen in Table 3, only 354 of the treatment households report participating in ACCESO. We hope that as the interventions are implemented for a longer period of time, participation in ACCESO will be more salient.

TABLE 3 BENEFICIARY ATTRIBUTION

	Control	*Treatment*	*Total*
Does not reports Participating in ACCESO	2152	820	2972
Reports Participating in ACCESO	0	354	354
Total	2152	1174	3326

Figure 1 and Figure 2 show the geographic distribution of the sample and their access to markets using the Euclidean distance to cities with 25 thousands or more habitants and the time to access the nearest market centers, respectively. The distance show us the radii that larger cities might influence and the time cost better reflect in economic term the difficulties in access. Under both measures, households in Lempira have the most limitations to access markets in their vicinity.

In summary, the final sample is well distributed across the departments of western Honduras and the attrition rate was relatively low. Together, we can conclude that the sample provides a good

representation of the different environments in which individuals perform their social and economic activities.

FIGURE 1 GEOGRAPHIC DISTRIBUTION OF HOUSEHOLDS AND DISTANCE TO 25K+ HABITANT CITIES

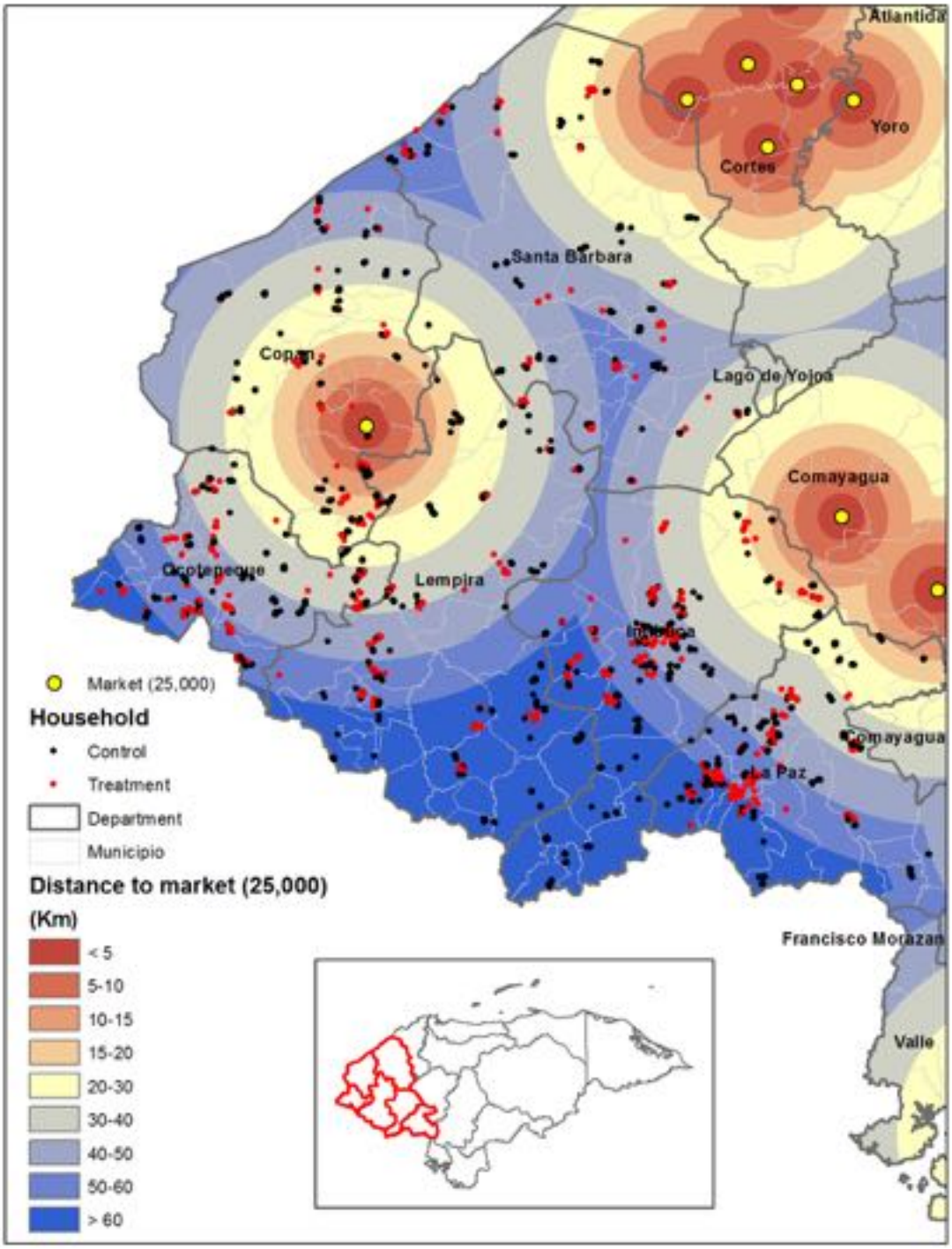
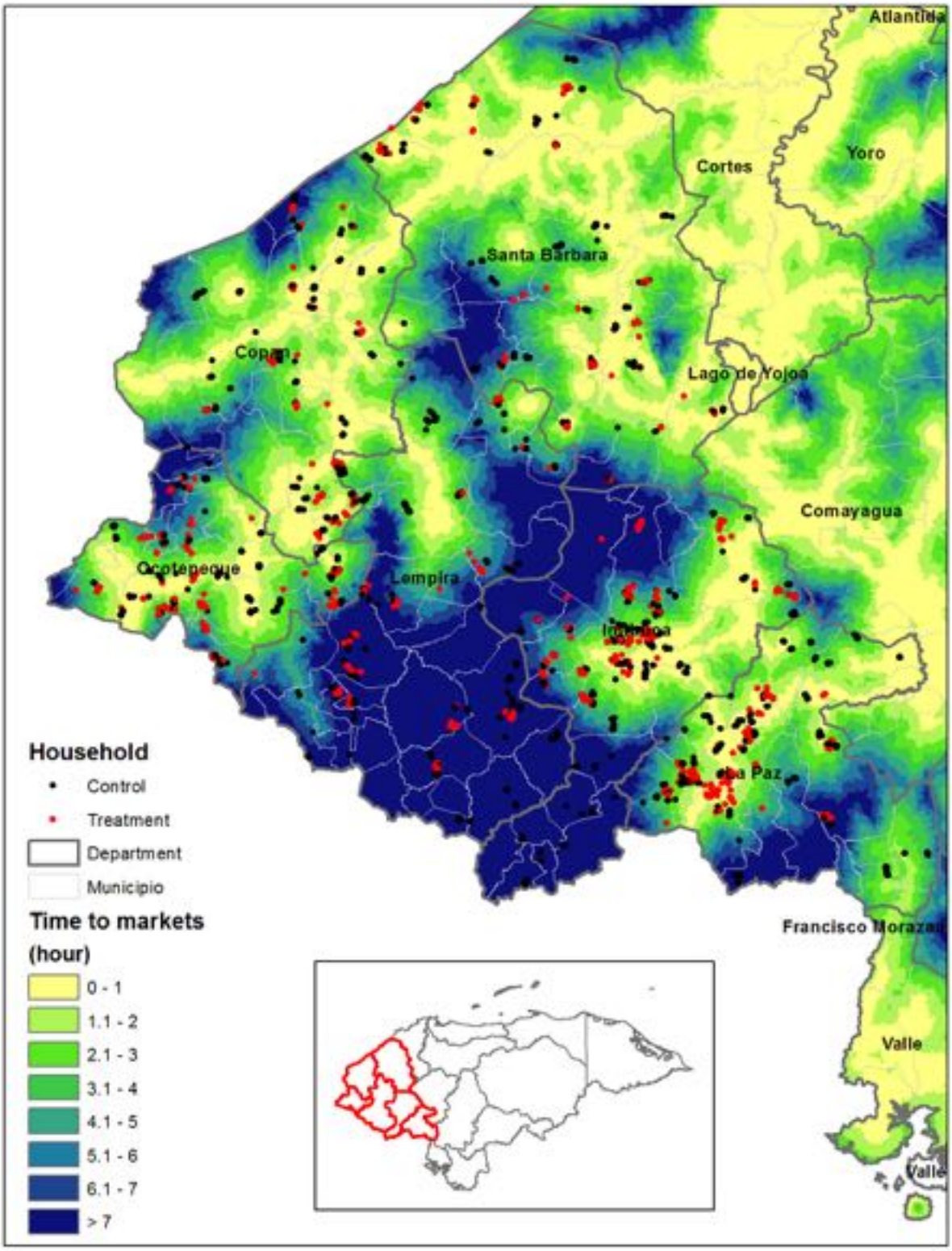


FIGURE 2 GEOGRAPHIC DISTRIBUTION OF HOUSEHOLDS AND TIME TO MARKETS



4 Results: Propensity Score Matching:

4.1 Matching

Below we present the estimated logistic regression, in Table 4, and the distribution of the odds ratio[15] before and after matching in Figure 3 through Figure 6. In Figure 3, we can see the considerable overlap of the probabilities of treatment for the selected sample after matching. There remains a region with little overlap to the right of the distribution. This is due to 2 treatment households that are outside of the region of common support, thus suitable control households are not available outside the common support region.

The variables included in the PSM equation are,

- Market Access: Transport cost ($/kg.), time to access a city with 50k+ population (hrs.), distance to 50k+ population city, distance to nearest market, total population of nearest 50k+ population city, population -in nearest market to 2012,
- Household composition and poverty: household size, per-capita day expenditure (in 2005 Purchase Power Parity (PPP)), indicator for living under $1.25 (PPP) per day, poverty areas
- Nutritional indicators: for underweight children, stunted children, wasted children and underweight women , anemic women and children living in the household, hunger scale score
- Agricultural land characteristics: type of soil, department indicators, and the size of planted area of corn, beans and coffee.

Using these variables we estimate the logit equation that is used to predict the probability of being a treatment household (propensity score). We present the distribution of the odds ratio under different weighting schemes to explore the robustness of the matching selection. First, we select the 7 nearest neighbors using 20 percent of the standard deviation of the estimated score as a caliper. This procedure selects the 7 observations from the control pool that are the

[15] We use the odds ratio to find the matches, given that this would allow the use of survey weights in the future. See Heckman and Todd (1995) which shows that implicit weights in the PSM estimator are proportional to the odds ratio when using survey weights. This is equivalent to matching on the propensity score and in this case there is no discernible difference if using one or the other.

nearest to each treatment household as long as the difference between the scores of the observations is less than the given caliper. Second, we use radius matching with the same caliper. The difference here is that all control observations with differences below the caliper are used to construct the matched control. Lastly, we use kernel weights[16], which are more flexible, using all observations in the control pool to construct the counterfactual for each treatment unit. As evidenced by the graphs, the nearest neighbor and kernel weighting schemes are able to replicate the distribution of scores of the treatment households; for all weighting schemes only 2 treatment households were outside of the area of common support. Our preferred specification is the kernel weighting using the tricube kernel as it weights the nearest neighbors similarly and has a compact support to avoid weighting observations that are father.

[16] We use a tri-cube kernel for the matching where the weights are calculated as : $K(x) = \frac{70}{81}(1 - |x|^3)^3 \, I_{\{|x|<1|\}}$

TABLE 4 LOGIT ESTIMATION OF THE PROPENSITY SCORE

Dependent Variable: Treatment Indicator

	Coefficient		Coefficient
TRANSPORT COST ($/Kg.)	-7.63	Hunger Scale	-0.04
	[5.05]		[0.22]
TIME TO ACCESS 50K CITY (HRS.)	-0.02	Anemic Women	-0.22
	[0.051]		[0.14]
DISTANCE TO 50K CITY	0.01	Anemic Children	0.12
	[0.0029]**		[0.14]
DISTANCE TO NEAREST MARKET	0.08	High Poverty Area	0.05
	[0.012]***		[0.12]
TOTAL POPULATION-50K CITY	-0.01	Medium Poverty Area	-0.35
	[0.0053]**		[0.13]***
POPULATION -IN NEAREST MARKET TO 2012	-0.03	Agricultural Soil type	0.18
	[0.0084]***		[0.088]**
HOUSEHOLD SIZE	0.15	Department 4	-0.35
	[0.022]***		[0.21]*
PER-CAPITA DAY EXPENDITURE (PPP)	0.04	Department 10	0.14
	[0.035]		[0.16]
Under $1.25 per day, Indicator	-0.23	Department 12	-0.34
	[0.10]**		[0.14]**
Underweight Children	-0.13	Department 13	-0.48
	[0.19]		[0.18]***
Stunted Children	0.20	Department 14	-0.43
	[0.12]		[0.27]
Wasted Children	-0.35	Corn Area	0.35
	[0.25]		[0.057]***
Underweight Women	-0.18	Beans Area	0.16
	[0.17]		[0.13]
Constant	-2.01	Coffee Area	0.17
	[0.27]***		[0.028]***
Observations		3326	
Pseudo R-squared		0.073	

Standard errors in second row

* p<0.10, ** p<0.05, *** p<0.01

FIGURE 3 SCORE DISTRIBUTION BEFORE MATCHING

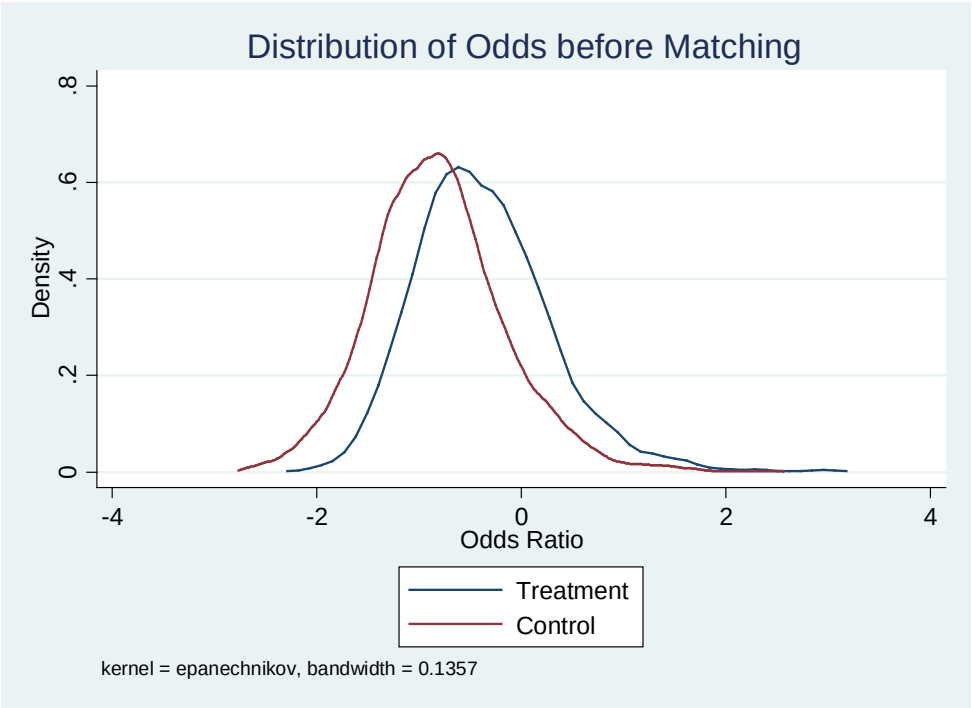


FIGURE 4 SCORE DISTRIBUTION AFTER MATCHING- NEAREST NEIGHBORS

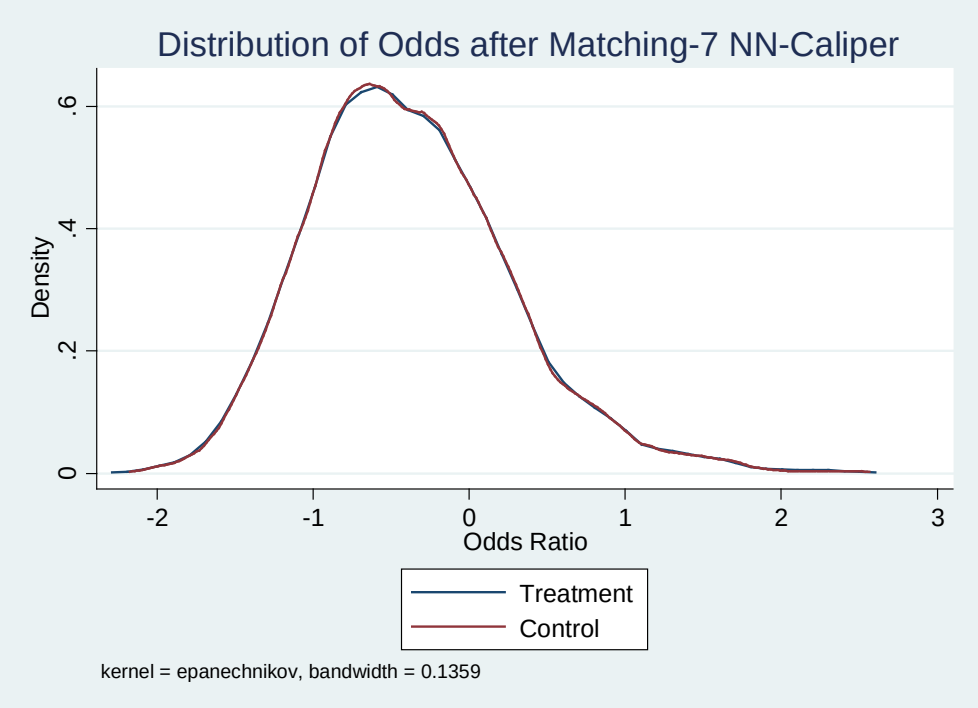


FIGURE 5 SCORE DISTRIBUTION AFTER MATCHING- RADIUS CALIPER

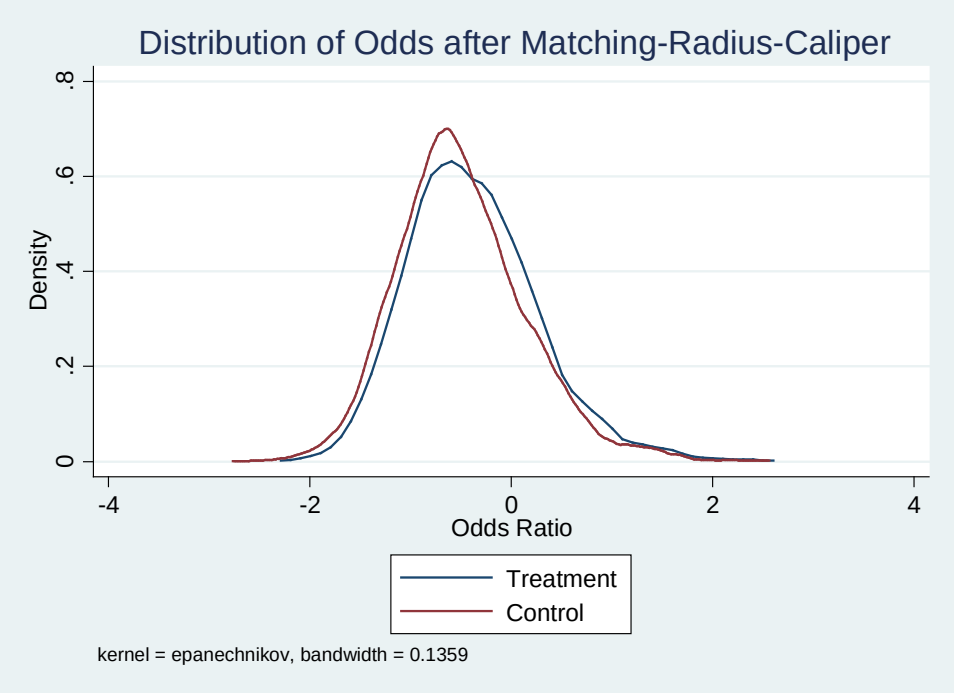
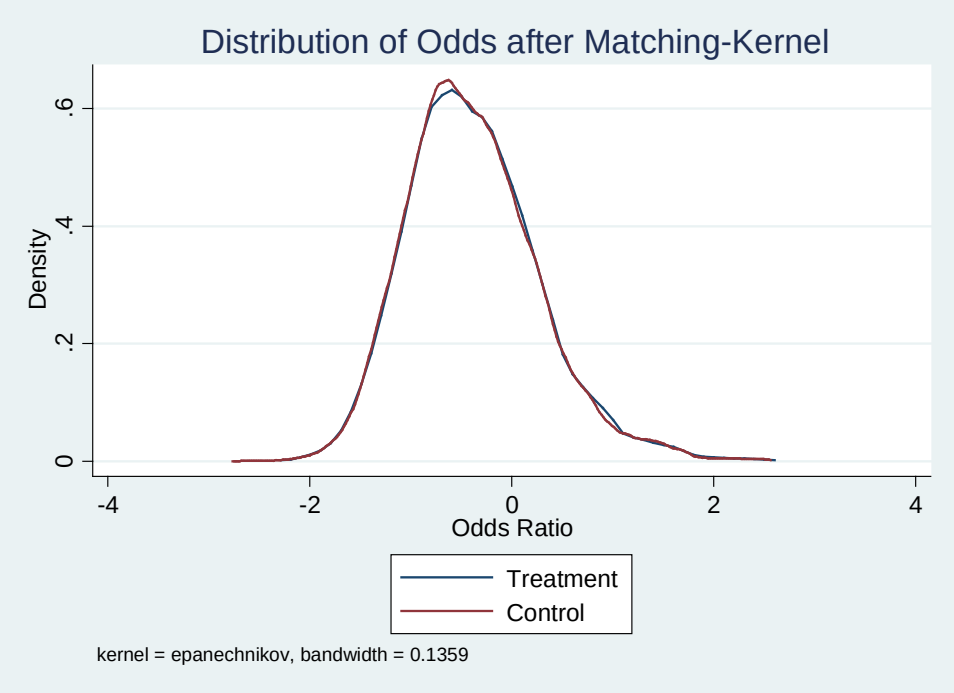


FIGURE 6 SCORE DISTRIBUTION AFTER MATCHING- KERNEL



Having the distribution of the scores similar in the control group is the first step in arguing that the PSM is a viable option in this setting. Second, we need to verify that the matching variables that were significantly different before matching are no longer significant. The idea behind these tests is to provide evidence that the treatment and control are comparable at least in observable variables to make the argument that unobservable variables are balanced also.

Table 5 and Table 6 show the results of these tests. Not surprisingly, the differences after matching are not significant for any of the variables included in the propensity score equation.

A stronger test is to explore differences in variables not included in the PSM estimation to see if they are balanced after matching. It is important to note that no PSM estimation will balance each and every variable that we have in the survey. Important variables, in the sense that they reflect directly the effect of ACCESO, should be balanced. In addition, this will serve to identify what variables might confound the estimated effect in future analyses.

TABLE 5 MATCHING VARIABLES: BALANCE TESTS (PART 1)

Variable		Mean		%reduct		t-test		
		Treated	Control	%bias	bias	t	p>t	
TRANSPORT COST ($/Kg.)	Unmatched	0.03	0.04	-8.4		-2.22	0.03	**
	Matched	0.03	0.03	0.9	89.2	0.26	0.80	
TIME TO ACCESS 50K CITY (HRS.)	Unmatched	5.47	5.69	-5.5		-1.46	0.15	
	Matched	5.47	5.46	0.1	98.6	0.02	0.98	
DISTANCE TO 50K CITY	Unmatched	77.00	78.05	-3		-0.83	0.41	
	Matched	77.02	78.08	-3.1	-1.2	-0.73	0.47	
DISTANCE TO MAIN MARKET	Unmatched	6.94	6.00	21.7		5.96	0.00	***
	Matched	6.94	7.00	-1.4	93.6	-0.33	0.74	
TOTAL POPULATION-50K CITY	Unmatched	4.21	4.58	-4.7		-1.24	0.21	
	Matched	4.19	4.17	0.2	96.7	0.04	0.97	
POPULATION -IN MAIN MARKET TO 2012	Unmatched	3.98	4.21	-4.3		-1.18	0.24	
	Matched	3.98	3.86	2.3	46.8	0.58	0.56	
HOUSEHOLD SIZE	Unmatched	5.60	4.83	33.6		9.36	0.00	***
	Matched	5.59	5.58	0.4	98.7	0.1	0.92	
PER-CAPITA DAY EXPENDITURE (PPP)	Unmatched	1.97	2.12	-10.4		-2.82	0.01	***
	Matched	1.97	1.97	0.2	98.1	0.05	0.96	
Under $1.25 per day, Indicator	Unmatched	0.32	0.29	5.4		1.49	0.14	
	Matched	0.32	0.32	-0.2	95.7	-0.06	0.96	
Underweight Children	Unmatched	0.06	0.06	1.9		0.53	0.60	
	Matched	0.06	0.06	-1	45.6	-0.25	0.81	
Stunted Children	Unmatched	0.18	0.15	9.4		2.62	0.01	***
	Matched	0.18	0.18	-1	89.6	-0.23	0.82	
Wasted Children	Unmatched	0.02	0.03	-4.8		-1.29	0.20	
	Matched	0.02	0.02	1.6	65.7	0.44	0.66	

* p<0.10, ** p<0.05, *** p<0.01

TABLE 6 MATCHING VARIABLES: BALANCE TESTS (PART 2)

		Mean		%reduct		t-test		
		Treated	Control	%bias	bias	t	p>t	
Underweight Women	Unmatched	0.05	0.05	-0.1		-0.03	0.98	
	Matched	0.05	0.05	0.9	-755.1	0.22	0.82	
Hunger Scale	Unmatched	0.03	0.03	-1.8		-0.5	0.62	
	Matched	0.03	0.03	-1.8	3.5	-0.43	0.67	
Anemic Women	Unmatched	0.08	0.08	0.3		0.09	0.93	
	Matched	0.08	0.08	0	94.9	0	1.00	
Anemic Children	Unmatched	0.10	0.08	6.1		1.69	0.09	*
	Matched	0.10	0.11	-1	82.7	-0.24	0.81	
High Poverty Area	Unmatched	0.65	0.60	11.3		3.09	0.00	***
	Matched	0.65	0.66	-1	91.2	-0.24	0.81	
Medium Poverty Area	Unmatched	0.16	0.21	-13.4		-3.64	0.00	***
	Matched	0.16	0.16	-0.1	99.6	-0.01	0.99	
Agricultural Soil type	Unmatched	0.58	0.55	5.1		1.41	0.16	
	Matched	0.58	0.57	1.2	76.3	0.29	0.77	
Department 4	Unmatched	0.16	0.17	-1.9		-0.51	0.61	
	Matched	0.16	0.15	2.3	-22.3	0.56	0.58	
Department 10	Unmatched	0.19	0.16	8.6		2.39	0.02	**
	Matched	0.19	0.19	0.8	91	0.18	0.86	
Department 12	Unmatched	0.17	0.17	-0.2		-0.05	0.96	
	Matched	0.16	0.16	1	-489	0.25	0.80	
Department 13	Unmatched	0.14	0.17	-7.4		-2.03	0.04	**
	Matched	0.14	0.15	-1.6	78.9	-0.39	0.70	
Department 14	Unmatched	0.16	0.17	-1.7		-0.46	0.65	
	Matched	0.16	0.17	-3.1	-88.9	-0.76	0.45	
Corn Area	Unmatched	0.65	0.38	33.8		9.66	0.00	***
	Matched	0.64	0.59	5.6	83.3	1.22	0.22	
Beans Area	Unmatched	0.16	0.09	20.7		5.99	0.00	***
	Matched	0.16	0.14	5.1	75.6	1.1	0.27	
Coffee Area	Unmatched	0.78	0.42	25.4		7.28	0.00	***
	Matched	0.77	0.73	2.7	89.4	0.56	0.58	

* p<0.10, ** p<0.05, *** p<0.01

4.2 Balancing Tests for Non-Matching Variables

That the matching procedure is able to match the distribution of the propensity scores is not surprising. It is always important to explore if the matched differences are balanced for variables that are important outcomes and useful covariates that will be used in the final impact estimation.

Given the richness of the data, we present a wide selection of indicators in which we explore differences at baseline and help us characterize the well-being of the households in the zone of influence.

4.2.1 Demographics and Household Characteristics

Table 7 describes the characteristics of the houses where individuals in the sample live. Individually the classifications are well balanced across treatments and controls and the tests show no significant differences between treatment and control groups. These figures give us a sense of the condition in which these individuals live. The characteristics of the houses show that over 40 percent of the sample lives in houses that have earth floors (which increase the probability of the transmission of diseases). Over 80 percent of the sample lives in houses where the walls are made from soil materials- coupled with the earth floors, these conditions can promote respiratory afflictions, especially among you children.

Table 8 shows that treatment households have slightly younger heads of household and that heads in treatment households are disproportionately male. These significant differences are important for future analyses, given that having a greater proportion of male-headed households in the treatment group might reflect targeting male-headed households to the detriment of female headed-households. This may have implications for the promotion of women's empowerment in the zone of influence.

To get at this, we explore differences across gendered household type. In Table 9, the proportion of adult female-only households (FNM) is higher in the control group. However, we note that the number of observations in this cell (and the male only cell) is small, with only 11 percent of the total sample in the FNM cell. We note this, because it will be important to explore gender effects

based on female (around 19 percent of the sample) or non-female headed household, as well as by gendered household type.

TABLE 7 DISTRIBUTION OF MATERIALS IN FLOORS, WALLS AND ROOFING

	Control		Treatment		Total	
FLOORS	Number	%	Number	%	Number	%
Dirt	980	45.92	496	42.80	1,476	44.82
Cement/Concrete	835	39.13	518	44.69	1,353	41.09
Superficial cement (lechada)	50	2.34	16	1.38	66	2.00
Mud brick	14	0.66	5	0.43	19	0.58
Wood	10	0.47	3	0.26	13	0.39
Ceramic	242	11.34	119	10.27	361	10.96
Other	3	0.14	2	0.17	5	0.15
Total	2,134	100.00	1,159	100.00	3,293	100.00
	Control		Treatment		Total	
WALLS	Number	%	Number	%	Number	%
Mud and Cane (adobe o bahareque)	1,760	82.47	985	84.99	2,745	83.36
Cement block	205	9.61	99	8.54	304	9.23
Brick	46	2.16	20	1.73	66	2.00
Wood	103	4.83	47	4.06	150	4.56
Plates	6	0.28	2	0.17	8	0.24
Waste materials	4	0.19	2	0.17	6	0.18
Other	10	0.47	4	0.35	14	0.43
Total	2,134	100.00	1,159	100.00	3,293	100.00
	Control		Treatment		Total	
ROOFING	Number	%	Number	%	Number	%
Asbestos plate	31	1.45	17	1.47	48	1.46
Zinc/Aluminum plates	1,032	48.38	557	48.06	1,589	48.27
Tiles	1,041	48.80	571	49.27	1,612	48.97
Straw	9	0.42	1	0.09	10	0.30
Waste materials	7	0.33	4	0.35	11	0.33
Cement	7	0.33	6	0.52	13	0.39
Other	6	0.28	3	0.26	9	0.27
Total	2,133	100.00	1,159	100.00	3,292	100.00

TABLE 8 AGE AND SEX OF HEAD OF HOUSEHOLD

			Percentiles				
	Mean	SE	25	50	75	Obs	
Control							
Age	46.75	0.36	33	45	59	2128	
Male head of household	0.76	0.01	1	1	1	2139	
Treatment							
Age	44.33	0.40	34	42.5	53	1153	
Male head of household	0.90	0.01	1	1	1	1163	
Total							
Age	45.90	0.27	34	44	56	3281	
Male head of household	0.81	0.01	1	1	1	3302	
		Raw-Diff			**Matched-Diff**		
Difference		t	p		t	p	
Age	2.42	4.28	0.00	2.66	4.48	0.00	***
Male head of household	-0.15	-10.39	0.00	0.09	-6.39	0.00	***

TABLE 9 GENDERED HOUSEHOLD TYPE

	Control		Treatment		Total	
	Number	%	Number	%	Number	%
Adult Female, No Male (FNM)	293	13.62	63	5.37	356	10.70
Adult Male, No Female (MNF)	93	4.32	46	3.92	139	4.18
Male and Female Adults (M&F)	1,766	82.06	1,065	90.72	2,831	85.12
Total	2,152	100	1,174	100	3,326	100

Table 10 shows the distribution of access to electricity/lighting sources, water and sanitationand energy use. Half of the households have their own electrical connection with the control group having a higher proportion with a private electricity connection. Over 70 percent of households are connected to the public water service and the proportion with access to a household tap connection is slightly higher in the control group. Finally, the primary fuel source is wood as expected in these mainly rural areas.

TABLE 10 ELECTRICITY, WATER AND FUEL SOURCES

	Control		Treatment		Total	
Electricity Source	Number	%	Number	%	Number	%
None/Daylight	330	15.46	201	17.36	531	16.13
Own Electric connection	1,218	57.05	559	48.27	1,777	53.96
Neighbor's electric connection	18	0.84	5	0.43	23	0.70
Kerosene (gas)	84	3.93	43	3.71	127	3.86
Candles	290	13.58	218	18.83	508	15.43
Solar Panel	51	2.39	57	4.92	108	3.28
Electric generator	16	0.75	14	1.21	30	0.91
Wood/Ocote	110	5.15	49	4.23	159	4.83
Other	18	0.84	12	1.04	30	0.91
Total	2,135	100.00	1,158	100.00	3,293	100.00
	Control		Treatment		Total	
Primary Water Source	Number	%	Number	%	Number	%
HH connection-Public service	1,519	71.15	850	73.34	2,369	71.92
HH connection-Private service	210	9.84	116	10.01	326	9.90
Public tap	56	2.62	24	2.07	80	2.43
Manual Well	79	3.70	43	3.71	122	3.70
Well with pump	3	0.14	3	0.26	6	0.18
Natural sources	160	7.49	94	8.11	254	7.71
Cistern truck	2	0.09	1	0.09	3	0.09
Bottled	46	2.15	13	1.12	59	1.79
From neighbor	34	1.59	5	0.43	39	1.18
Other	26	1.22	10	0.86	36	1.09
Total	2,135	100.00	1,159	100.00	3,294	100.00
	Control		Treatment		Total	
Primary Fuel Source	Number	%	Number	%	Number	%
Electricity	66	3.09	7	0.60	73	2.22
Propane gas	44	2.06	5	0.43	49	1.49
Kerosene	13	0.61	3	0.26	16	0.49
Charcoal	1	0.05	1	0.09	2	0.06
Wood	2,003	93.82	1,139	98.27	3,142	95.39
Agricultural residues	1	0.05	-	-	1	0.03
Other	7	0.33	4	0.35	11	0.33
Total	2,135	100.00	1,159	100.00	3,294	100.00

For completeness we show the unweighted test for these categorical variables in Table 11. We note that the appropriateness of these tests is debatable, due to the small size of some cells in addition to not using the PSM adjustment. In any case, the raw differences point to significant differences in these variables (especially electricity) with treatment households tending to have poorer levels in these variables. These differences will be taken into account using regression methods in the impact estimates.

TABLE 11 TESTS FOR INDEPENDENCE OF ROWS AND COLUMNS

	Raw-Diffs chi	p-value	
Gendered Household Type	55.27	0.00	***
House ownership	35.88	0.00	***
What kind of lighting does the household have?	45.75	0.00	***
Principal drinking water source	16.31	0.06	*
Principal source of water for other uses	8.66	0.37	
Principal fuel source	38.58	0.00	***
Principal waste outlet	48.15	0.00	***
Type of sanitation service	41.34	0.00	***
Main floor material	13.11	0.04	**
Main wall material	3.81	0.70	
Main roof material	3.54	0.74	

4.2.2 Expenditures

Next we present results from comparing indicators of household economic well-being for treatment and control groups. We present the measures of expenditures across different categories, including food and non-food expenditures. As is well known, individuals tend to under-report their own income, hence the consensus is measures relying on self-reported income are unreliable; thus we focus on the consumption expenditures of households, which more faithfully reflect economic well-being. With this caveat in mind, in the following section we present some important measures of income.

Expenditures are composed of the following items: food (including food purchased, food consumed out of the household and self-supplied food products) and non-food items (including transportation, non-durable household products, educational expenses, clothes, shoes, travel expenses). Housing expenditures include rent for renters, expected rental value for owners, utility payments, and fuel expenses. Expenditures on durable goods and tax payments are excluded. Deaton and Zaidi (1999).

Table 12 disaggregates annual per capita (PC) expenditures by the categories mentioned above and presents per capita-day expenditures in current US dollars and 2005 PPP (Purchasing Power Parity) dollars. The descriptive statistics are similar across the treatment and controls, but prior to matching the measures can be seen to be significantly different across the treatment and control groups. Matching effectively reduces these differences which are no longer significant

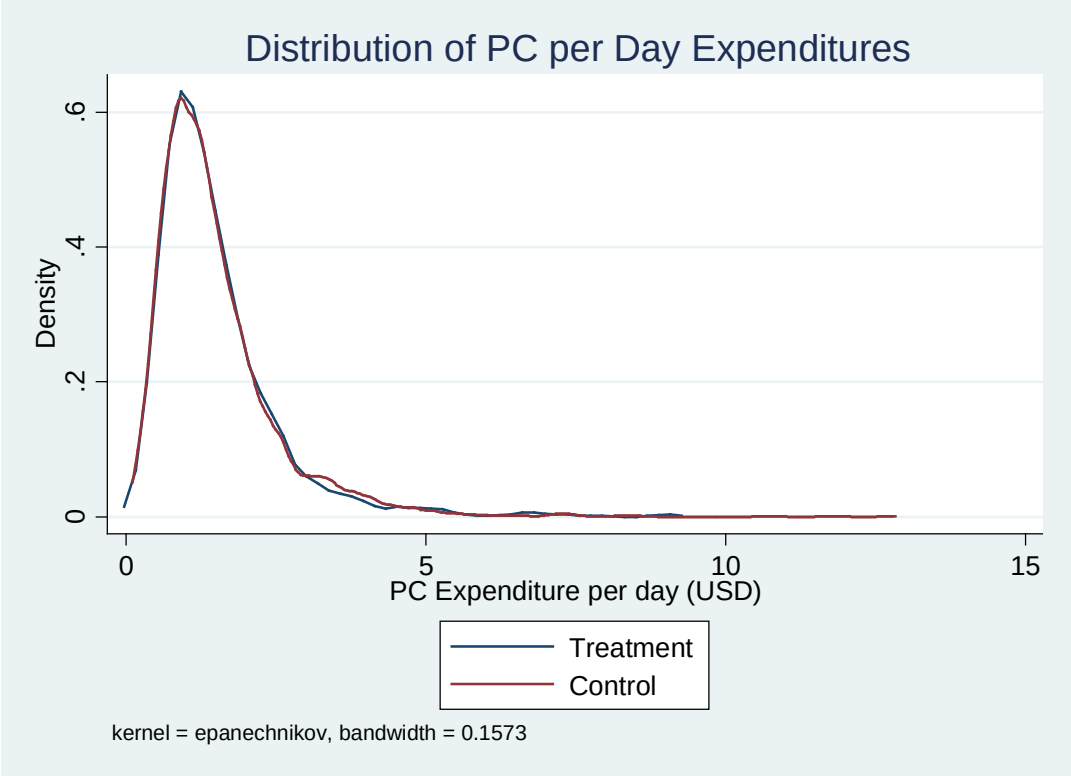
following the PSM procedure. Figure 7 shows the resulting distribution of expenditures after matching: there are no systematic differences between treatment and control groups.

TABLE 12 EXPENDITURES BY CATEGORY

	Mean	SE	25	50	75	Obs
Control						
Annual PC Expenditure (USD)	588.17	9.17	318.26	484.08	712.13	2,152
Food Expenditures	288.10	4.49	156.87	237.71	362.66	1,983
Non-food Expenditures	114.92	3.10	29.20	68.01	141.70	2,152
Housing Expenditures	207.78	4.22	99.07	156.39	240.38	2,152
PC Expenditure per day (USD)	1.61	0.03	0.87	1.33	1.95	2,152
PC Expenditure per day (2005-PPP-USD)	2.12	0.03	1.15	1.75	2.57	2,152
Indicator for people living <$1.25 per day	0.29	0.01	0.00	0.00	1.00	2,152
Treatment						
Annual PC Expenditure (USD)	546.42	10.93	310.72	449.93	664.79	1,174
Food Expenditures	269.82	5.30	156.47	222.49	331.62	1,098
Non-food Expenditures	113.70	3.85	30.28	70.57	150.83	1,174
Housing Expenditures	180.37	4.75	91.59	134.00	222.28	1,174
PC Expenditure per day (USD)	1.50	0.03	0.85	1.23	1.82	1,174
PC Expenditure per day (2005-PPP-USD)	1.97	0.04	1.12	1.62	2.40	1,174
Indicator for people living <$1.25 per day	0.32	0.01	0.00	0.00	1.00	1,174
Total						
Annual PC Expenditure (USD)	573.43	7.08	316.36	474.51	698.84	3,326
Food Expenditures	281.58	3.46	156.87	231.17	350.20	3,081
Non-food Expenditures	114.49	2.43	29.64	68.87	143.95	3,326
Housing Expenditures	198.11	3.21	96.53	141.71	227.57	3,326
PC Expenditure per day (USD)	1.57	0.02	0.87	1.30	1.91	3,326
PC Expenditure per day (2005-PPP-USD)	2.07	0.03	1.14	1.71	2.52	3,326
Indicator for people living <$1.25 per day	0.30	0.01	0.00	0.00	1.00	3,326
		Raw-Diff			**Matched-Diff**	
Difference		t	p		t	p
Annual PC Expenditure (USD)	41.74	2.82	0.005	-1.18	-0.05	0.96
Food Expenditures	18.27	2.53	0.011	5.03	0.69	0.49
Non-food Expenditures	1.22	0.24	0.810	-3.42	-0.62	0.53
Housing Expenditures	27.41	4.09	0.000	-1.45	-0.20	0.84
PC Expenditure per day (USD)	0.11	2.82	0.005	-0.003	-0.05	0.96
PC Expenditure per day (2005-PPP-USD)	0.15	2.82	0.005	-0.004	-0.05	0.96
Indicator for people living <$1.25 per day	-0.02	-1.49	0.14	0.002	0.06	0.96

* p<0.10, ** p<0.05, *** p<0.01

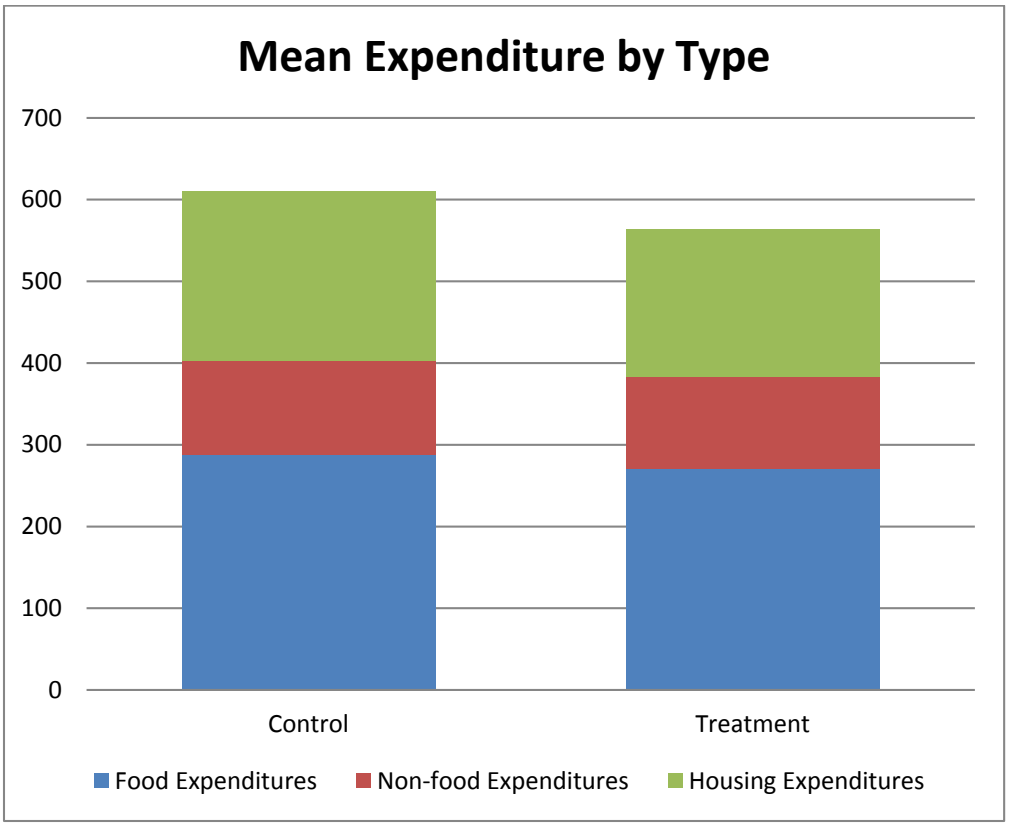
FIGURE 7 DISTRIBUTION OF PC PER DAY EXPENDITURES



Median annual per-capita expenditure in the total sample is $474.51 and the mean is $573.43, higher than the median due to the skewedness of the distribution. The inter-quartile[17] range for the sample is $382.48 which is 80 percent of median total expenditures, implying small levels of inequality in the lower part of the expenditure distribution. Note that across the quartiles the share of food expenditures is around 50 percent. This is somewhat unexpected as households in the top quartile of the distribution tend to allocate a smaller share of their expenditures towards food; however, this can be reconciled by taking noting that most of these household are still poor, even those in higher quartiles. Figure 8 presents mean annual per-capita expenditures for each of the categories. Little difference between treatment and control groups is observed across categories.

[17] The interquartile range is the difference between the 75th percentile and the 25th percentile.

FIGURE 8 MEAN EXPENDITURE BY TYPE



We previously mentioned that the projects target the poor in the western departments of Honduras. To gauge poverty levels of the households in the sample, we calculated daily consumption/expenditure per capita and converted this figure to 2005 PPP dollars to use the international poverty line.

FIGURE 9 DISTRIBUTION OF PC PER DAY EXPENDITURES, 2005 PPP$

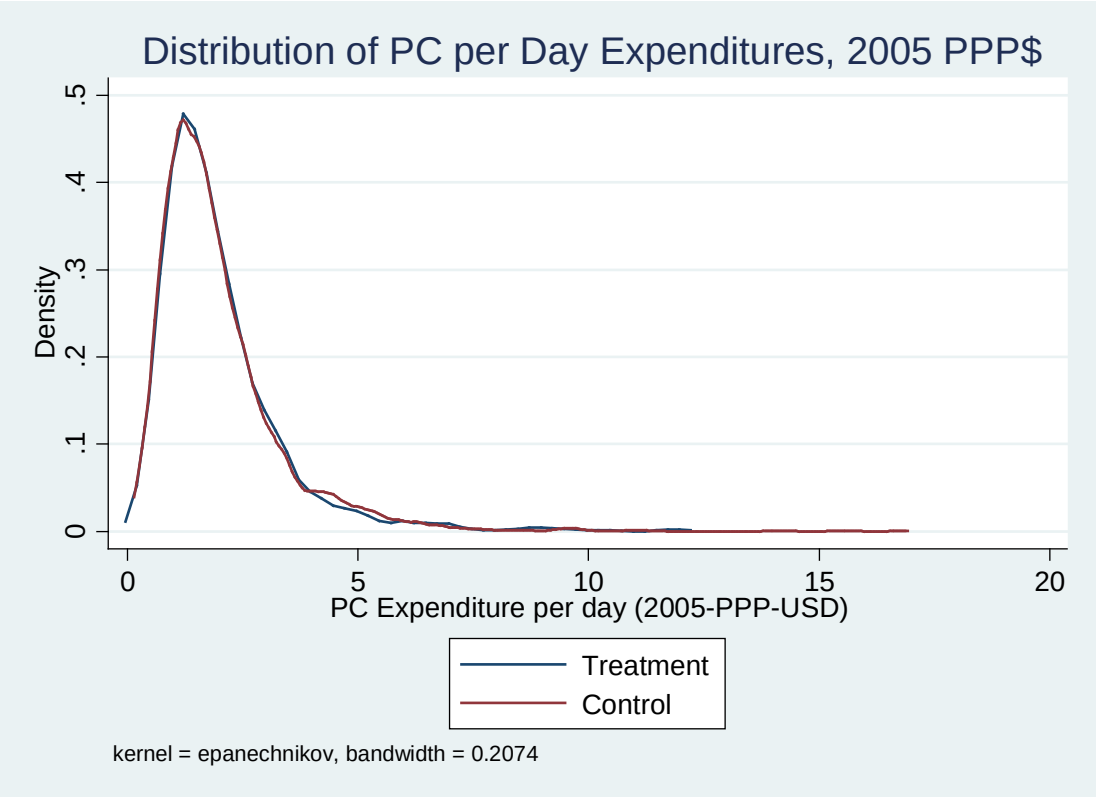
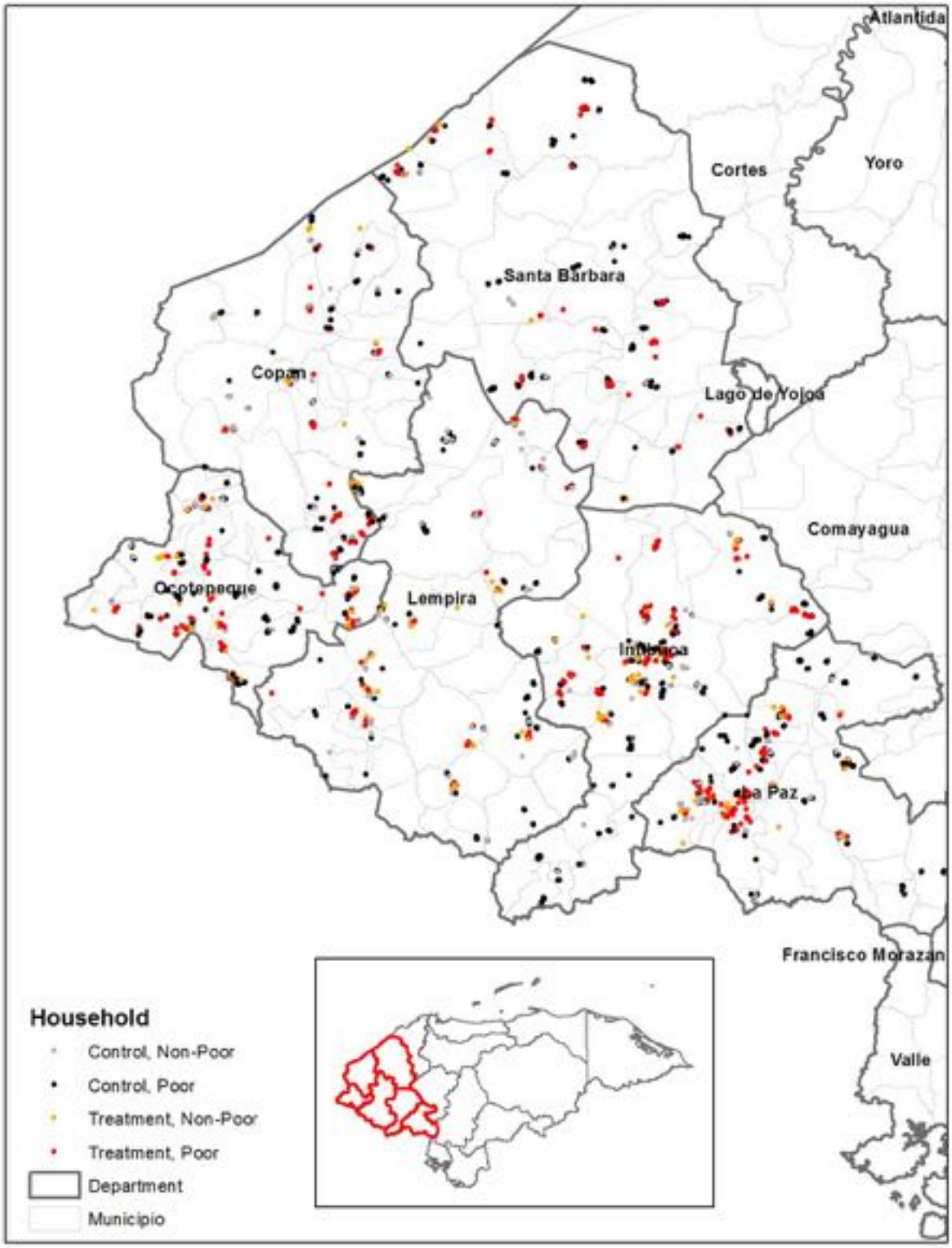


Figure 9 shows the distribution of expenditures per capita per day in PPP terms. Together with Table 12, we can see that the distribution is concentrated in the range of $1 to $2 per day. Around 30 percent of the households live on under $1.25 per day. Furthermore, we note that over 50 percent of households live on less than $2 per person per day. The incidence of poverty at the 1.25 $PPP poverty line is moderate with 30 percent of households classified as poor.

Figure 10 shows the distribution of poor households by treatment and control groups across the area of influence of ACCESO. As expected the poor households tend to be at the margin of the city clusters.

FIGURE 10 GEOGRAPHIC DISTRIBUTION OF POVERTY



4.2.3 Income

For completeness, and to see the labor market and transfer dynamics in these households, we construct a measure of income that incorporates the main categories from which households may derive a regular flow of income. This includes income from salaries, independent work, agricultural production, livestock and derived products, in-kind payments and transfers (remittances). Net income is gross income minus transfers to people outside the household and agricultural input costs[18].

As mentioned before, the income we estimate understates the figure obtained from the expenditure data; the estimated per capita income represents around 65% of the expenditure per capita estimated. Table 13 shows the descriptive statistics for the annual income variables in current USD. However, we note that the matching procedure does not improve the comparability for this measure, perhaps because is noisy and does not reflect the real distribution of income of these households.

We proceed to present the tests for some of the components of net income. This will give us a sense of what components are driving the significant differences observed. Table 14 shows the income figures by source. There no significant differences among the groups for the wage/salary income or for the transfer[19].

[18] Salaries and independent work sources of income are net of costs.

[19] Transfer are Winsorized. Winsorizing replaces extreme values, both high and low, with percentiles of the distribution (for example, the 5th and the 95th for the transfer variable) to limit the influence of these outliers.

TABLE 13 NET INCOME (CURRENT USD)

	Mean	SE	25	50	75	Obs
Control						
Net HH Income	1784.78	71.73	467.63	1190.79	2095.78	1,869
Income Per Capita	383.89	10.73	98.44	226.47	508.07	1,869
Income Per Capita per Day	1.05	0.03	0.27	0.62	1.39	1,869
Treatment						
Net HH Income	2205.79	117.40	476.31	1053.18	2490.06	1,086
Income Per Capita	373.04	15.02	83.50	198.07	492.19	1,086
Income Per Capita per Day	1.02	0.04	0.23	0.54	1.35	1,086
Total						
Net HH Income	1939.50	62.71	471.02	1135.80	2254.55	2,955
Income Per Capita	379.90	8.75	92.88	217.74	507.63	2,955
Income Per Capita per Day	1.04	0.02	0.25	0.60	1.39	2,955
		Raw-Diff			**Matched-Diff**	
Difference		t	p		t	p
Net HH Income	-421.02	-3.24	0.00	-160.20	-0.78	0.44
Income Per Capita	10.85	0.60	0.55	-19.92	-0.96	0.34
Income Per Capita per Day	0.03	0.60	0.55	-0.05	-0.96	0.34

TABLE 14 HOUSEHOLD INCOME BY SOURCES (CURRENT USD)

	Mean	SE	25	50	75	Obs	
Control							
Total income from main jobs	1659.18	36.85	804.44	1524.21	2222.80	986	
Total Transfers In	477.01	33.92	88.22	317.54	476.31	739	
Net Transfers	397.30	76.20	88.17	317.54	423.39	744	
Net Transfers (Winsorized .05)	335.25	11.87	79.39	281.03	402.22	767	
Treatment							
Total income from main jobs	1539.72	60.93	731.62	1220.95	2179.61	362	
Total Transfers In	367.10	25.88	121.72	338.71	375.76	504	
Net Transfers	367.10	25.88	121.72	338.71	375.76	504	
Net Transfers (Winsorized .05)	317.73	12.09	88.46	317.54	365.17	516	
Total							
Total income from main jobs	1627.10	31.55	762.10	1487.16	2215.18	1,348	
Total Transfers In	432.45	22.77	95.26	317.54	402.22	1,243	
Net Transfers	385.11	46.60	88.67	317.54	396.93	1,248	
Net Transfers (Winsorized .05)	328.21	8.60	84.68	317.54	391.64	1,283	
	Raw-Diff				**Matched-Diff**		
Difference		t	p		t	p	
Total income from main jobs	119.46	1.68	0.09	5.7	0.07	0.942	
Total Transfers In	109.91	2.37	0.02	80.05	1.8	0.073	*
Net Transfers	30.20	0.32	0.75	-68	-0.52	0.606	
Net Transfers (Winsorized .05)	17.52	1.00	0.32	14.72	0.88	0.379	

* p<0.10, ** p<0.05, *** p<0.01

4.3 Agricultural Production and Farm Activities

4.3.1 Production, Crop Values and the Productivity of Land

In this section we discuss the main issues and indicators for agriculture dependent households. We first identified the three main crops reported by the households: beans, corn and coffee. For these main crops we calculate the production for the past year and use the reported prices to create a representative price for each region and use these prices to calculate the value of production.

Table 15 shows the results for production and area planted of beans, corn and coffee [20] for the year before the survey (2011-2012 seasons). Average production of beans is 5 quintals. Corn production was on average 18.6 and coffee production was on average 38.7 quintals. These figures can be placed into context, before discussing the land productivity, by noting that the average planted areas of beans, corn and coffee were 0.94, 0.51 and 1.70 manzanas[21], respectively. Before matching there are significant differences in the value of the production between the treatment and control group. The differences here are driven by the significant differences in the production of beans across these groups, with the treatment group having a larger production.

[20] One quintal is equal to 100 Lbs.

[21] One manzana is equivalent to 6,961 square meters or approximately 0.7 hectares

TABLE 15 PRODUCTION OF MAJOR CROPS

			Percentiles				
	Mean	SE	25	50	75	Obs	
Control							
Beans production (Quintals)	4.74	0.63	1.00	2.50	5.00	379	
Corn production (Quintals)	15.66	0.48	6.00	12.00	20.00	871	
Coffee production (Quintals)	35.71	5.33	5.00	15.00	35.00	374	
Beans Area (Winsorized .01) (Mz)	0.88	0.03	0.50	0.75	1.00	931	
Corn Area (Winsorized .01) (Mz)	0.48	0.02	0.19	0.50	0.50	417	
Coffee Area (Winsorized .01) (Mz)	1.69	0.09	0.50	1.00	2.00	535	
Treatment							
Beans production (Quintals)	5.29	0.37	1.50	4.00	6.00	315	
Corn production (Quintals)	22.32	1.22	8.00	15.00	25.00	699	
Coffee production (Quintals)	40.47	3.37	9.00	20.00	40.00	377	
Beans Area (Winsorized .01) (Mz)	1.02	0.03	0.50	1.00	1.00	748	
Corn Area (Winsorized .01) (Mz)	0.56	0.03	0.25	0.50	0.67	342	
Coffee Area (Winsorized .01)	1.72	0.09	0.50	1.00	2.00	535	
Total							
Beans production (Quintals)	4.99	0.38	1.00	3.00	6.00	694	
Corn production (Quintals)	18.62	0.61	7.00	12.00	22.00	1570	
Coffee production (Quintals)	38.10	3.14	7.00	18.00	38.00	751	
Beans Area (Winsorized .01) (Mz)	0.94	0.02	0.50	0.80	1.00	1679	
Corn Area (Winsorized .01) (Mz)	0.51	0.02	0.21	0.50	0.50	759	
Coffee Area (Winsorized .01) (Mz)	1.70	0.06	0.50	1.00	2.00	1070	
		Raw-Diff			**Matched-Diff**		
Difference		t	p		t	p	
Beans production (Quintals)	-0.55	-0.72	0.47	-0.54	-0.66	0.51	
Corn production (Quintals)	-6.65	-5.46	0.00	-4.72	-3.19	0.00	***
Coffee production (Quintals)	-4.76	-0.76	0.45	1.75	0.31	0.75	
Beans Area (Winsorized .01) (Mz)	-0.14	-3.23	0.00	0.04	-7.04	0.28	
Corn Area (Winsorized .01) (Mz)	-0.08	-2.16	0.03	-0.01	-1.62	0.92	
Coffee Area (Winsorized .01) (Mz)	-0.03	-0.22	0.82	0.45	1.15	0.00	***

* p<0.10, ** p<0.05, *** p<0.01

To provide a measure of the resources that household agricultural production can provide, we estimate the value of the production from these crops by using the median prices for each crop in each department as reported by the households. To verify the robustness to outliers, we Winsorized the price data to lie within the interdecile range (from the 10^{th} to the 90^{th} percentiles) and within the interquartile range (from 25^{th} to 75^{th} percentiles). In Table 16, we see that the estimated mean value of the (aggregated) production of beans, corn and coffee in the sample ranges from $1,535 with the reported prices to $1,645 using the prices from the interdecile price distribution.

It is important to disaggregate this figure by crop, since the farmers that are obtaining the major part of their agricultural income from coffee are likely very different than those whose main crop is corn. Table 16 also shows the estimated value of each crop (using reported prices). The mean value of the coffee production is very high and is evidently driven by some outliers in the production figures. In these cases, the median is more informative: for coffee the median value of the production is $1,455. For corn and beans the values are lower, as expected, with median value of beans production estimated at $119, followed by corn production at $214.

We use the values of production and the area planted discussed to estimate the productivity of land for the household in the sample. First we measure the productivity of land in dollars per manzana ($/Mz) across the 3 major crops and the yield in quintals per manzana (Q/Mz.) for each crop individually. Table 16 also presents these results. Average productivity is estimated at 760 $/Mz and median productivity at 400$/Mz. The distribution is very 'unequal' with a ratio of the interquartile range to the median of 1.9.

For the these 3 major crops we estimate the yield productivities (Q/Mz) trimming productivity levels that fall above the levels that one would expect when using good technologies. The levels used are: 55 Q/Mz for beans, 160 Q/Mz for corn and 24 Q/Mz for coffee[22]. Beans productivity is on average 7.21 Q/Mz with 75 percent of the sample having productivities under 8 Q/Mz, which seems relatively low for the area. In the case of corn productivity is almost 24 Q/Mz. The figure for coffee is 10.78 Q/Mz. We note that the estimates are precisely estimated are similar to the national figures from 1993 agricultural census[23] that where 21.6 Q/Mz for corn, 7.7 Q/Mz for beans and 10.8 Q/Mz for coffee; and in the more recent Basic Agricultural Survey 2009 productivity for corn is estimated at 26.9 Q/Mz and for beans at 10.4 Q/Mz. In this light our estimated productivity is below the national averages.

[22] We use the limits described in the Fintrac Technical Proposal for Corn and Beans (slightly higher) and the estimated high yields in the area for coffee.
[23] http://www.ine.gob.hn/drupal/sites/default/files/Serie_Censo_Agropecuario.pdf

TABLE 16 PRODUCTIVITY AND VALUE OF MAJOR CROPS

			Percentiles				
	Mean	SE	25	50	75	Obs	
Control							
Total crop value (Winsorized .10)	1378.54	112.91	169.36	376.42	899.04	1080	
Total crop value (Winsorized .25)	1309.71	107.32	169.36	369.41	886.47	1080	
Total crop value (Imputed Prices)	1290.76	101.98	163.80	357.24	920.71	1080	
Beans revenue	202.48	32.30	41.02	95.26	211.70	379	
Corn revenue	262.09	7.90	111.14	190.53	333.42	871	
Coffee revenue	2966.50	284.43	447.21	1204.02	3175.43	374	
Productivity, (Winsorized .05) in $/Mz	706.29	25.29	180.47	370.47	857.37	1070	
Beans Productivity in Q/Mz	7.00	0.45	2.00	4.00	8.00	353	
Corn Productivity in Q/Mz	25.26	0.90	14.00	24.00	38.00	242	
Coffee Productivity in Q/Mz	10.33	0.41	4.50	10.00	15.60	266	
Treatment							
Total crop value (Winsorized .10)	1967.60	152.72	238.16	529.24	1651.22	896	
Total crop value (Winsorized .25)	1874.98	134.31	238.16	550.41	1672.39	896	
Total crop value (Imputed Prices)	1829.80	132.95	232.86	541.15	1620.79	896	
Beans revenue	219.33	15.87	63.51	127.02	254.03	315	
Corn revenue	362.60	19.05	129.66	238.16	423.39	699	
Coffee revenue	3600.62	283.21	635.09	1799.41	4048.67	377	
Productivity, (Winsorized .05) in $/Mz	826.28	30.07	222.28	463.52	1058.48	884	
Beans Productivity in Q/Mz	7.46	0.74	2.00	4.56	8.00	294	
Corn Productivity in Q/Mz	22.18	1.01	10.67	20.00	32.00	181	
Coffee Productivity in Q/Mz	11.26	0.42	6.00	10.00	16.00	247	
Total							
Total crop value (Winsorized .10)	1645.64	92.97	199.79	444.03	1190.79	1976	
Total crop value (Winsorized .25)	1566.03	84.77	198.46	428.68	1190.79	1976	
Total crop value (Imputed Prices)	1535.18	82.30	190.53	417.77	1190.79	1976	
Beans revenue	210.13	19.04	52.92	119.08	222.28	694	
Corn revenue	306.84	9.63	127.02	214.34	370.47	1570	
Coffee revenue	3284.83	200.89	529.24	1455.40	3638.51	751	
Productivity, (Winsorized .05) in $/Mz	760.57	19.45	196.88	399.90	956.45	1954	
Beans Productivity in Q/Mz	7.21	0.42	2.00	4.00	8.00	647	
Corn Productivity in Q/Mz	23.94	0.68	12.00	21.43	35.00	423	
Coffee Productivity in Q/Mz	10.78	0.29	5.00	10.00	16.00	513	
		Raw-Diff			**Matched-Diff**		
Difference		t	p		t	p	
Total crop value (Winsorized .10)	-589.05	-3.16	0.00	-231.80	-0.82	0.41	
Total crop value (Winsorized .25)	-565.26	-3.33	0.00	-216.40	-0.91	0.36	
Total crop value (Imputed Prices)	-539.05	-3.27	0.00	-152.90	-0.61	0.54	
Beans revenue	-16.85	-0.44	0.66	-18.10	-0.43	0.51	
Corn revenue	-100.51	-5.23	0.00	-68.33	-2.91	0.00	***
Coffee revenue	-634.12	-1.58	0.11	17.70	0.19	0.75	
Productivity, (Winsorized .05) in $/Mz	-119.99	-3.08	0.00	-148.08	-3.49	0.00	***
Beans Productivity in Q/Mz	-0.46	-0.55	0.59	-1.23	-1.39	0.17	
Corn Productivity in Q/Mz	3.08	2.27	0.02	2.71	1.88	0.06	*
Coffee Productivity in Q/Mz	-0.93	-1.60	0.11	-1.39	-2.27	0.02	**

* p<0.10, ** p<0.05, *** p<0.01

4.3.2 Small scale and garden production

The survey also allows us to measure smaller-scale production activities in household and community gardens. Table 17 shows that around 30 percent of the households have a garden that they use for small scale agricultural production. The input cost to maintain these gardens is moderate, with most household having no expenses, and the labor allocation to these plots is 7.9 hours per week on average. Among the households that sell their garden production, the average income they obtain is estimated at $171. The main significant difference is on the proportion of households that have a garden. The difference is 8 percentage points with treatment household being more likely to have a garden. This difference is not economically significant at this point, since some households can report small plots as agricultural production in the previous section of the questionnaires. In the future, this indicator may shed evidence on the small scale activities under ACCESO since using the difference in difference estimation we would expect that small household plots will be more prominent in the treatment group, so the growth in this variable should be greater in the control group versus the treatment group.

TABLE 17 SMALL SCALE-GARDEN PRODUCTION

			Percentiles				
	Mean	SE	25	50	75	Obs	
Control							
Has a Patio Garden	0.28	0.01	0.00	0.00	1.00	2099	
Total Expenditure on Garden Inputs (Winsorized .05)	13.33	1.16	0.00	0.00	10.58	574	
Garden Sales, (Winsorized .05)	158.51	27.18	15.88	52.92	132.63	74	
Labor Hrs. per Wk. for Garden	7.82	0.78	1.00	2.00	6.00	588	
Treatment							
Has a Patio Garden	0.36	0.01	0.00	0.00	1.00	1133	
Total Expenditure on Garden Inputs (Winsorized .05)	18.32	1.60	0.00	0.00	26.46	395	
Garden Sales, (Winsorized .05)	185.83	28.26	33.34	74.09	255.36	68	
Labor Hrs. per Wk. for Garden	8.05	0.82	1.00	3.00	8.00	406	
Total							
Has a Patio Garden	0.31	0.01	0.00	0.00	1.00	3232	
Total Expenditure on Garden Inputs (Winsorized .05)	15.37	0.95	0.00	0.00	15.88	969	
Garden Sales, (Winsorized .05)	171.60	19.55	26.46	60.86	217.73	142	
Labor Hrs. per Wk. for Garden	7.92	0.57	1.00	2.00	6.00	994	
		Raw-Diff			**Matched-Diff**		
Difference		t	p		t	p	
Has a Patio Garden	-0.08	-4.51	0.00	-0.05	-2.50	0.01	**
Total Expenditure on Garden Inputs (Winsorized .05)	-4.99	-2.59	0.01	-4.72	-2.05	0.04	**
Garden Sales, (Winsorized .05)	-27.32	-0.70	0.49	-21.25	-0.48	0.63	
Labor Hrs. per Wk. for Garden	-0.23	-0.20	0.84	-0.83	-0.70	0.49	

* p<0.10, ** p<0.05, *** p<0.01

4.3.3 Other Farm Activities

To complete the discussion on productive activities we present Table 18 which describes the income and costs from selling livestock and derived products such as dairy products, eggs, etc. The number of households that report participating in these activities is large, with about 70 percent of the sample reporting engaging in animal husbandry. However, few report sales from these activities as can be seen from the number of observations in each cell of Table 18. Most these households engage in aviculture for their own consumption.

TABLE 18 INCOME FROM OTHER FARM ACTIVITIES

			Percentiles			
	Mean	SE	25	50	75	Obs
Control						
Milk Sales, (Winsorized .05)	43.63	13.12	3.70	16.83	36.52	26
Other Dairy Sales, (Winsorized .05)	42.76	13.80	1.96	6.35	31.75	29
Total livestock sales	80.90	33.00	7.94	15.88	95.26	33
Total transport costs associated with livestock sales	13.55	12.91	0.64	13.55	26.46	2
Treatment						
Milk Sales, (Winsorized .05)	24.02	10.18	2.54	8.55	21.17	22
Other Dairy Sales, (Winsorized .05)	15.48	3.56	3.18	9.53	21.49	31
Total livestock sales	144.04	48.93	10.58	31.75	105.85	49
Total transport costs associated with livestock sales	72.75	69.48	1.27	5.29	211.70	3
Total						
Milk Sales, (Winsorized .05)	34.64	8.54	2.59	9.24	29.24	48
Other Dairy Sales, (Winsorized .05)	28.66	7.08	2.75	7.99	23.45	60
Total livestock sales	118.63	32.14	8.47	26.46	105.85	82
Total transport costs associated with livestock sales	49.07	40.93	1.27	5.29	26.46	5
		Raw-Diff			**Matched-Diff**	
Difference		t	p		t	p
Milk Sales, (Winsorized .05)	19.61	1.15	0.26	16.13	1.25	0.22
Other Dairy Sales, (Winsorized .05)	27.28	1.97	0.05	29.00	1.98	0.05 *
Total livestock sales	-63.14	-0.96	0.34	-42.03	-0.57	0.57
Total transport costs associated with livestock sales	-59.20	-0.66	0.56	-58.70	-0.75	0.51

* p<0.10, ** p<0.05, *** p<0.01

4.3.4 Credit Constraints

The ability of households in developing countries to access efficient credit markets has long been identified in the economics literature as a major impediment to growth. The absence of properly functioning credit markets can affect long-run economic performance Banerjee and Newman (1993). In the rural context, constrained access to credit has been shown to affect a wide variety of outcomes, including capital allocation Carter and Olinto (2003), the size and productivity of farm holdings Feder (1985)and even gender bias and time allocation Rose (2000)

While the identification of limitations in credit access was not a primary objective of the survey design, it was possible to incorporate a simple methodological approach to distinguish between the different types of barriers to credit access that respondents face. Following the procedure of Boucher, Guirkinger, and Trivelli (2009), respondents who had not applied for a formal loan in the previous year were asked a series of hypothetical questions in order to categorize households based on the type(s) of impediments to accessing credits which they face.

Using this methodology, those who did not have formal credit were categorized as follows: quantity constrained (households who applied for a formal loan and were rejected, or who applied for a loan but received less than their preferred amount); risk constrained (those who wanted to apply for a loan but did not because of fear of the risk, particularly the possibility of losing land put up as collateral); and transaction cost rationed (those who wanted to apply for a loan but either the formal institution was too far away, or the amount of documentation required presented too great a burden). We also identify unconstrained households with a latent demand for credit but who were put off by the cost of the loan itself as price-rationed. Though not technically constrained, these households would take out formal credit were more competitively priced loan products available, i.e. under lower interest rates.

Table 19 presents the mean response rates for the sample, disaggregated by treatment and control groups. Note that it is possible, indeed common, for households who did not receive credit to report facing multiple constraints. Thus a household which reported not applying for credit because of fear of default and because the nearest bank branch is too far away would be categorized as both risk and transaction costs constrained.

Notably, credit access is significantly higher in treatment households, with treatment households 16.8 percentage points more likely to report receiving a loan in the past year. Treated households were also more likely to identify themselves as quantity rationed, while control households were more likely to be constrained by high costs and the perceived riskiness of loans, although these differences are not statistically significant.

These results are suggestive of broad unmet demand for formal financial products. Over 50 percent of the sample did not apply for a formal loan because the cost was too high, while more than a 20 percent were constrained by the perceived risks involved. Based on these results, households in the zone of influence could benefit from initiatives that decrease interest rates- or otherwise lower the costs associated with taking out a loan- to promote broader credit market inclusion.

TABLE 19 CREDIT ACCESS AND CONSTRAINTS

	Mean	SE	Obs				
Control							
Household received loan in last year	0.147	0.008	2,010				
Quantity constrained	0.175	0.008	2,152				
Price constrained	0.515	0.011	2,152				
Risk constrained	0.231	0.009	2,152				
Transaction Cost constrained	0.049	0.005	2,152				
Treatment							
Household received loan in last year	0.316	0.014	1,109				
Quantity constrained	0.218	0.012	1,174				
Price constrained	0.483	0.015	1,174				
Risk constrained	0.209	0.012	1,174				
Transaction Cost constrained	0.038	0.006	1,174				
Total							
Household received loan in last year	0.207	0.007	3,119				
Quantity constrained	0.190	0.007	3,326				
Price constrained	0.504	0.009	3,326				
Risk constrained	0.223	0.007	3,326				
Transaction Cost constrained	0.045	0.004	3,326				
		Raw-Diff			**Matched-Diff**		
Difference		t	p		t	p	
Household received loan in last year	-0.168	-11.33	0.000	-0.128	-7.04	0.00	***
Quantity rationed	-0.043	-3.01	0.003	-0.028	-1.62	0.11	
Price rationed	0.032	1.76	0.079	0.024	1.15	0.25	
Risk rationed	0.022	1.47	0.141	0.010	0.58	0.56	
Transaction Cost rationed	0.011	1.45	0.148	0.008	0.92	0.36	

4.3.5 Mobile Access

Table 20 presents the responses of treatment and control households to the survey module on access to information technologies (IT). In line with recent global trends, we find high levels of cell phone penetration with 67 percent of households reporting having access to at least one mobile device. There is a statistically significant difference in the access to mobile phones of 8 percentage points; however, this difference is small enough that it is insignificant in economic terms. Internet access remains very low: 98 percent of households surveyed reported that they did not have access to the internet in any form (including cyber cafes, or via the local school).

The spread of access to mobile telephony throughout the developing world has had significant economic effects[24]. Of particular interest in the context of rural development is the potential for mobile phones to transmit price information. Recent studies have demonstrated that mobile telephones can reduce price dispersion in rural markets Jensen (2007); Aker and Fafchamps (2011)and even lead to increased sales of some agricultural commodities Muto and Yamano (2009) depending on the perishability of the crop. In addition, the evidence of the effects of ICT's in the Central American region is very limited[25].

Given the relatively high mobile phone penetration, we are able to draw some inferences from households' reported usage of cell phones. More than half of the sample in both the treatment and control groups (56 percent and 50 percent respectively) reports using a cell phone to contact a friend or family member business information or information relating to credit. The significant differences between the treatment and control group come from households that report carrying out transactions relating to agricultural or processed products using mobiles with a 9 percentage points lower proportion of control households reporting using a mobile phone for purchases and 10 percentage points lower proportion for sales of such products. The role of mobile technology in agricultural prices and nutrition information diffusion is a promising area for further

[24] Aker and Mbiti (2010) present a comprehensive overview of the effects on information and communication technologies on 'development' outcomes.

[25] We have highlighted in previous reports the possibility of conducting a randomized experiment under the ACCESO intervention to explore the complementarities of agricultural extension, nutrition information, and information technologies in increasing food security among poor rural households.

investigation in subsequent analyses of the dynamics of poverty and productivity within the zone of influence.

TABLE 20 ACCESS TO INFORMATION TECHNOLOGIES

	Mean	SE	Obs				
Control							
Access to Internet	0.02	0.00	2152				
Access to Mobile Phone	0.64	0.01	2152				
Cell Use 1: Contacting a family member or friend for business/lending information	0.50	0.01	1378				
Cell Use 2: Contacting a government agency or department?	0.02	0.00	1378				
Cell Use 3: To purchase agricultural or processed products?	0.07	0.01	1378				
Cell Use 4: To sell agricultural or processed products?	0.07	0.01	1378				
Treatment							
Access to Internet	0.02	0.00	1174				
Access to Mobile Phone	0.72	0.01	1174				
Cell Use 1: Contacting a family member or friend for business/lending information	0.56	0.02	842				
Cell Use 2: Contacting a government agency or department?	0.04	0.01	842				
Cell Use 3: To purchase agricultural or processed products?	0.16	0.01	842				
Cell Use 4: To sell agricultural or processed products?	0.17	0.01	842				
Total							
Access to Internet	0.02	0.00	3326				
Access to Mobile Phone	0.67	0.01	3326				
Cell Use 1: Contacting a family member or friend for business/lending information	0.52	0.01	2220				
Cell Use 2: Contacting a government agency or department?	0.03	0.00	2220				
Cell Use 3: To purchase agricultural or processed products?	0.10	0.01	2220				
Cell Use 4: To sell agricultural or processed products?	0.11	0.01	2220				
		Raw-Diff			**Matched-Diff**		
Difference		t	p		t	p	
Access to Internet	0.00	0.41	0.68	0.00	-0.09	0.93	
Access to Mobile Phone	-0.08	-4.56	0.00	-0.05	-2.47	0.01	**
Cell Use 1: Contacting a family member or friend for business/lending information	-0.06	-2.74	0.01	-0.04	-1.52	0.13	
Cell Use 2: Contacting a government agency or department?	-0.02	-2.62	0.01	-0.02	-2.28	0.02	**
Cell Use 3: To purchase agricultural or processed products?	-0.09	-6.76	0.00	-0.06	-3.78	0.00	***
Cell Use 4: To sell agricultural or processed products?	-0.10	-7.37	0.00	-0.08	-4.36	0.00	***

* p<0.10, ** p<0.05, *** p<0.01

4.3.6 Health and Nutrition for Women and Children

The health and nutrition interventions under ACCESO are an integral part of the mechanism to decrease poverty and under-nutrition through the benefits that crop diversification and increases in agricultural productivity can have to the diet of beneficiary households.

Not surprisingly, the main indicators are balanced, as they were included in the PSM procedure. The only significant differences are, as expected, the likelihood of having received information about the nutrition practices in general and foods that promote the adequate growth and weight in children, specific objectives from the ACCESO intervention.

There are few households that are identified as suffering from chronic or persistent hunger, only 3 percent of the households in the sample. The lean season is starts around April when the stocks from the postrera harvest of December start to dwindle and last until August when the primera harvest becomes available. Taking into account that the survey was done May-July, the levels of hunger, as measured by the scale, seem extremely low for the lean season. On the health status of children, of particular importance is the proportion of households[26] with stunted or anemic children. In Table 21, descriptive statistics relating to Health and Nutrition in the Household are presented. The proportion of households with at least one child falling below two standard deviations of the reference population in height for age, defined as stunted, is 44 percent. The proportion of households with anemic children is 29 percent. These figures highlight the problems of under nutrition in this area of Honduras.

The main nutritional indicators for women (age 15 to 49) that are important to follow are the proportion of women with adequate dietary diversity and anemia. Around 50 percent of households in the sample report having women with an adequate dietary diversity, with 13 percent of households having at least one woman that is anemic. In addition, on the intensive

[26] We opt to use household level measures, as opposed to individual level measures, to better reflect the condition of all members of the households given the high intra-household correlation of these measures. In addition the propensity score estimation is done at the household level. The readers interested in descriptive statistics of these measures at the individual level are directed to "Appendix C - ZOI Performance Monitoring Indicator"

margin of dietary diversity[27], the household average number of food groups consumed by women is 3.39.

[27] Though a simple measure to construct, simple food group diversity has been shown to be a good proxy for the adequacy of the quantity of micronutrients in women's diets, see Arimond et al. (2010)

TABLE 21 HOUSEHOLD HEALTH AND NUTRITION

	Control			Treatment			Total			Raw-Diff			Matched-Diff			
	Mean	SE	Obs	Mean	SE	Obs	Mean	SE	Obs		t	p		t	p	
Households has moderate or severe hunger	0.04	0.00	2,017	0.03	0.01	1,122	0.03	0.00	3,139	0.004	0.60	0.55	0.004	0.48	0.63	
Household received nutrition	0.08	0.01	1,719	0.13	0.01	1,021	0.10	0.01	2,740	-0.051	-4.35	0.00	-0.035	-2.49	0.01	**
Heard information on GROWTH in children?	0.89	0.03	139	0.88	0.03	135	0.89	0.02	274	0.011	0.28	0.78	-0.013	-0.29	0.77	
Heard information WEIGHT in children?	0.53	0.04	139	0.57	0.04	134	0.55	0.03	273	-0.042	-0.69	0.49	-0.019	-0.28	0.78	
Treat nutrition-Growth	0.00	0.00	139	0.17	0.03	135	0.08	0.02	274	-0.170	-5.32	0.00	-0.170	-4.43	0.00	***
Treat nutrition-Health	0.00	0.00	139	0.10	0.03	135	0.05	0.01	274	-0.104	-4.00	0.00	-0.104	-3.32	0.00	***
Treat nutrition-Any	0.00	0.00	139	0.17	0.03	135	0.08	0.02	274	-0.170	-5.32	0.00	-0.170	-4.43	0.00	***
Proportion Underweight (Children)	0.17	0.01	740	0.17	0.02	432	0.17	0.01	1,172	-0.001	-0.06	0.95	-0.004	-0.14	0.89	
Proportion Stunted	0.41	0.02	761	0.49	0.02	432	0.44	0.01	1,193	-0.078	-2.62	0.01	-0.025	-0.76	0.45	
Proportion Wasted	0.02	0.00	721	0.02	0.01	419	0.02	0.00	1,140	0.001	0.16	0.87	-0.007	-0.96	0.34	
Proportion Anemic (Children)	0.27	0.02	662	0.30	0.02	394	0.29	0.01	1,056	-0.030	-1.03	0.30	-0.003	-0.08	0.94	
Women have adequate dietary diversity	0.49	0.02	526	0.51	0.03	299	0.50	0.02	825	-0.013	-0.35	0.73	-0.008	-0.20	0.84	
Proportion Breastfed	0.74	0.05	74	0.86	0.05	50	0.79	0.04	124	-0.117	-1.57	0.12	-0.116	-1.42	0.16	
Proportion Underweight (Women)	0.09	0.01	1,359	0.08	0.01	796	0.08	0.01	2,155	0.006	0.50	0.61	-0.002	-0.17	0.86	
Mean Women Dietary Diversity (Average food groups)	3.39	0.03	1,524	3.37	0.04	893	3.39	0.02	2,417	0.018	0.37	0.71	0.035	0.60	0.55	
Proportion Anemic (Women)	0.13	0.01	1,342	0.12	0.01	794	0.13	0.01	2,136	0.009	0.59	0.56	0.001	0.15	0.88	
Proportion Pregnant (Eligible Women)	0.08	0.01	1,700	0.06	0.01	985	0.07	0.00	2,685	0.013	1.26	0.21	0.013	1.17	0.24	

4.3.7 Women Empowerment

Women play an essential role in the in the effort to promote agricultural growth in developing economies. However, some of the potential arenas where women can participate in the agricultural sector are limited by social and economic constraints. The Women's Empowerment in Agriculture Index (WEAI) measures the empowerment, agency, and inclusion of women in the agriculture sector in an effort to identify ways to overcome those obstacles and constraints. The Index explores the links between women's empowerment, food security, and agricultural growth. It measures the roles and extent of women's engagement in the agriculture sector in five domains: (1) decisions about agricultural production, (2) access to and decision making power over productive resources, (3) control over use of income, (4) leadership in the community, and (5) time use. It also measures women's empowerment relative to men within their households. [Alkire et al. (2012)]

The WEAI is a composite measurement tool that indicates women's control over critical parts of their lives in the household, community, and economy. It allows us to identify women who are disempowered and understand how to increase autonomy and decision-making in key domains.

As the measurement of empowerment is at the center of the Feed the Future interventions, the questionnaire included the variables necessary to calculate this indicator. Table 22 shows the result from our calculations using the methodology in Alkire et al. (2012).

The first element of the WEAI is the 5DE index which measures if women are empowered across the five dimensions mentioned before, within their households and their communities. It is composed by the disempowered head count ratio and the average adequacy score of disempowered individuals which measure disempowerment at the extensive and intensive margin. The disempowered head count ratio measures the proportion of males and females in the population that are classified as disempowered. The average adequacy ratio measures the intensity of the disempowerment of each individual as a function of the areas where each individual feels they can make decisions. The adequacy score ranges from 0, for individuals that do not make decisions in any of the five domains, and 1 for those that participate in all domains.

From Table 22 we see that 68.5 percent of the women in our sample are classified as disempowered in comparison to 39.9 of the males. The inadequacy scores are similar but women experience inadequacy in more domains than men. The 68.5 percent of women who are not yet empowered have, on average, inadequate achievements in 38.7 percent of domains. The 5DE index is one minus the product of these two measures and in our sample implies that the women in the sample have adequate empowerment in 73 percent of the indicators; this is below the 80 percent recommended cut off, above which a woman would be classified as empowered. In addition it is well below the empowerment of men, with 87.6 percent of the indicators being classified as adequate for them.

The other part of the WEAI is the Gender Parity Index (GPI). The GPI measures the level of inequality within dual households. A household enjoys parity if the principal female is empowered or, if she is not empowered, her adequacy score is greater than or equal to that of the primary male in her household. In a similar fashion to the 5DE index, the GPI is comprised of 2 margins of parity. On the extensive margin we have the gender parity-inadequate head count ratio, which measures the proportion of households where women have not achieved adequate gender parity. On the intensive margin we have the average empowerment gap (censored parity inadequacy scores), which measures the average percentage gap among the households classified as gender parity-inadequate, (i.e. is the normalized difference between the female and males inadequacy scores for dual households that are gender parity-inadequate). The gender parity index is then obtained as one minus the product of the headcount and the average empowerment gap.

In our sample, 58 percent of dual households are classified as gender parity-inadequate. The intensity of the inequality within households is given by the average empowerment gap. Of the 58 percent of women who are less empowered, the empowerment gap between them and the males in their households is 21.8 percent, which is relatively large. The gender parity index in our sample is 0.874

Finally, the WEAI is obtained by combining the GPI and the 5DE index. The index is:

$$WEIA = 0.9 * (5DE\ Index) + 0.1 * (GPI\ Index)$$

In our sample, the WEAI is 0.749 which is below the 0.80 recommended cut-off to classified women as empowered[28].

TABLE 22 WOMEN EMPOWERMENT INDEX

	Female	Male
DISEMPOWERED HEADCOUNT (H_20p)	0.685	0.399
AVERAGE INADEQUACY SHARE (A_20p)	0.387	0.311
5 DOMAINS DISEMPOWERMENT INDEX (M0_20p)	0.265	0.124
5 DOMAINS EMPOWERMENT INDEX (EA_20P)	0.735	0.876
	Dual Households	
PARITY INADEQUACY HEAD COUNT (H_GPI)	0.581	
CENSORED PARITY INADEQUACY SCORES AVERAGE	0.218	
GENDER DISPARITY INDEX (PI)	0.126	
GENDER PARITY INDEX (GPI)	0.874	
WOMEN EMPOWERMENT IN AGRICULTURE INDEX	**0.749**	

5 Qualitative Methods

Another part of the impact evaluation comprises the integration qualitative questions to inform the conclusion suggested by our quantitative methodology. The use of mixed methods in evaluation is necessary not only for the triangulation of findings but also for achieving a thorough understanding of the different design, operational or contextual factors that may have fostered or hindered the achievement of a program's expected impacts.

The Qualitative questions will be used to better understand the knowledge, attitudes, priorities, preferences, and perceptions of target beneficiaries. The idea is that important information about perceptions, attitudes towards the program, incentives to participate as well as unexpected indirect effects of the program on household or community dynamics that might be missed by the use of purely quantitative methods. Qualitative methods are particularly useful

[28] See Appendix D – Decomposition of Women Empowerment Index in Agriculture for a decomposition by indicator of the WEAI

for acquiring a more in-depth understanding of the factors that influence program operations or impact.

The main themes that will be explored in the qualitative analysis are:

- How does contact with extension workers has changed from year to year?
- What are the reasons that participants in extension and training programs feel that the knowledge transmitted is useful or not useful?
- What kind of themes and knowledge are agricultural workers most interested in learning about?
- What type of obstacles do household face to access credit and how they believe this could be improved?
- What are the avenues that women perceive as most advantageous to change and improved nutritional outcomes of children and women, especially during the 1,000 days from the start of a woman's pregnancy to a child second birthday?

6 Conclusions

We have performed an in-depth analysis of the baseline survey designed to evaluate feed the future intervention in western Honduras, with various goals in mind. First, to validate some of the assumptions in the research; second, it was important to document the changes in the treatment households in the sample due to lack of saliency of the project activities. Finally, the baseline survey describes the situation in which the potential beneficiaries live. We have explored the main indicators that are expected to change because of the interventions. We have also attempted to uncover any possible differences between the treatment and control households that might hinder the validity of the evaluation design. We also believe that we are in a position to understand the mechanisms through which these interventions affect the well-being of beneficiaries.

6.1 Lessons and Plans for Future Analyses

The results from the baseline analysis show that the research design appears to be appropriate. Treatment and control groups appear very similar in observable characteristics after the matching procedures. The differences that remain can be easily controlled for using regression-adjusted difference-in-differences.

For future analyses it is important to explore the possibility of using a regression discontinuity design on the base of market access and the poverty of households as measured by the implementers. One possibility for doing this is to obtain a complete list of the intervention areas and allocate treatment status within each major market[29] based on this list. The idea would be that within specific markets the probability of treatment assignment might be discontinuous in the level of market access reflecting the higher probabilities of selecting into treatment, both from the implementer's side and the household decision side.

In an effort to the decrease the burden of respondents and minimize attrition, for the follow-up survey we are decreasing the breath of issues address in the baseline survey without compromising the quality of the data for the main impact indicators.

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[29] See the Appendix A – Geographical Distribution and Market Access for maps that describe the market access of the households in the sample.

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8 Appendix A – Geographical Distribution and Market Access

FIGURE 11 GEOGRAPHIC DISTRIBUTION OF MARKET ACCESS TIME AND POVERTY

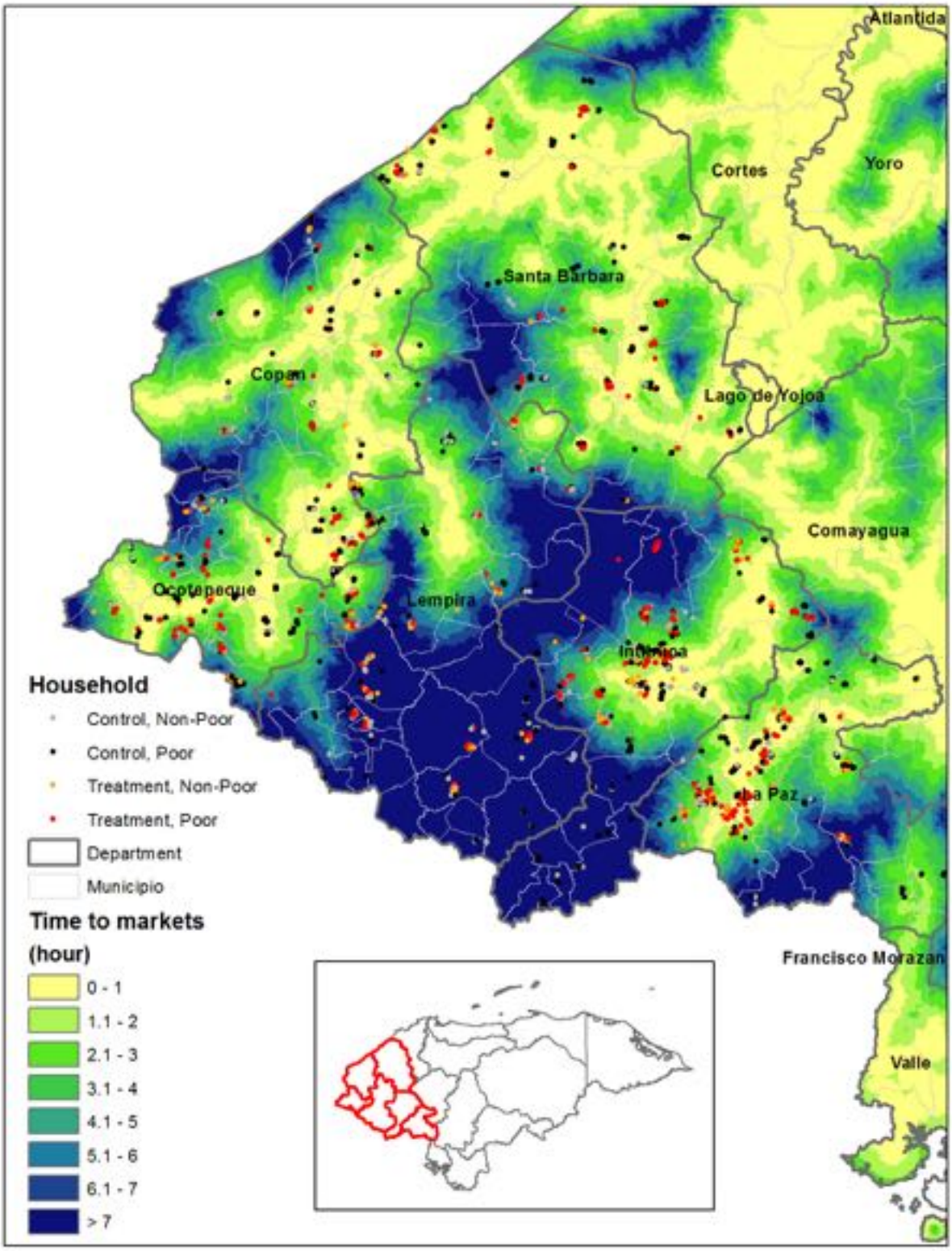


FIGURE 12 GEOGRAPHIC DISTRIBUTION OF COST TO MARKET ACCESS ($/KG.)

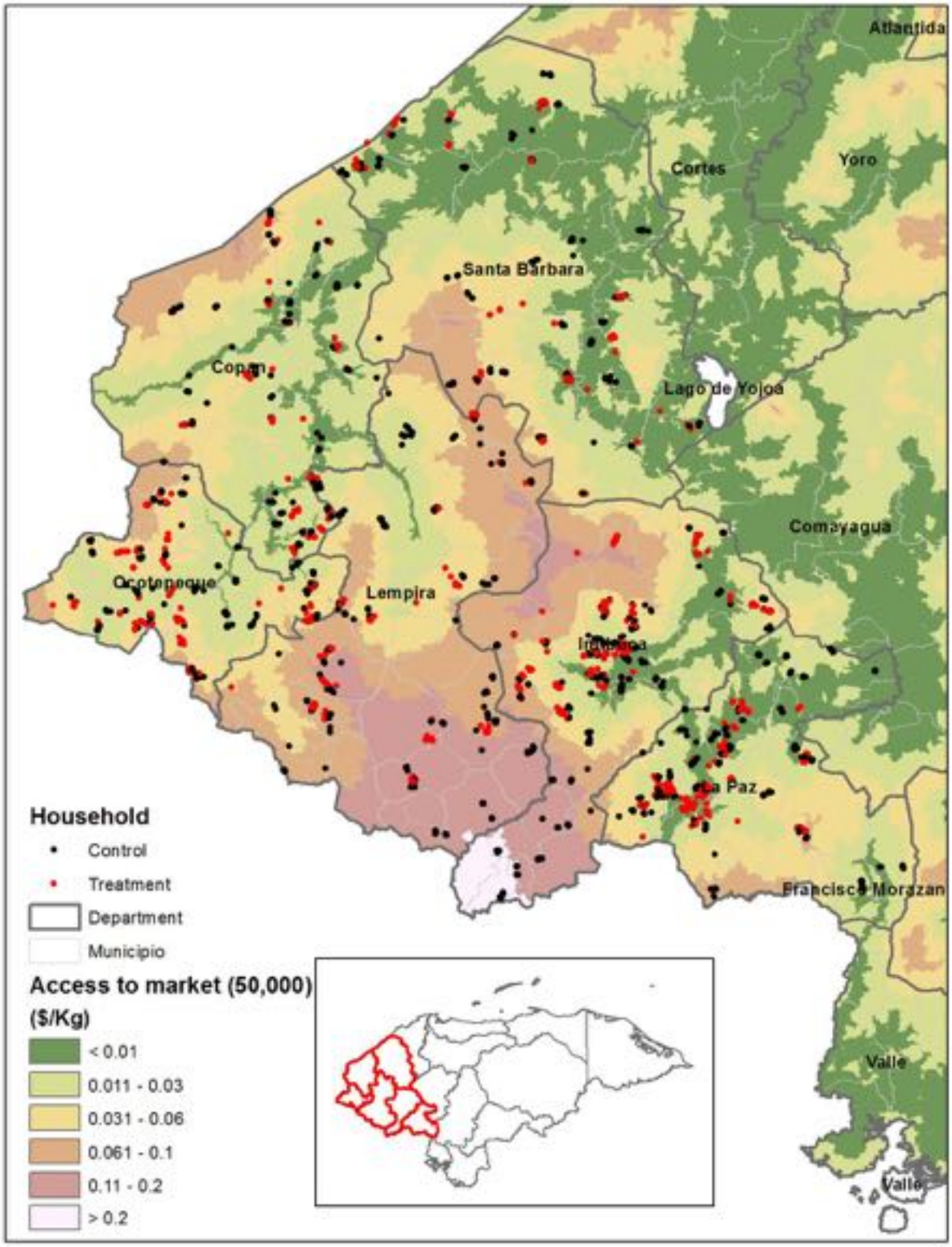
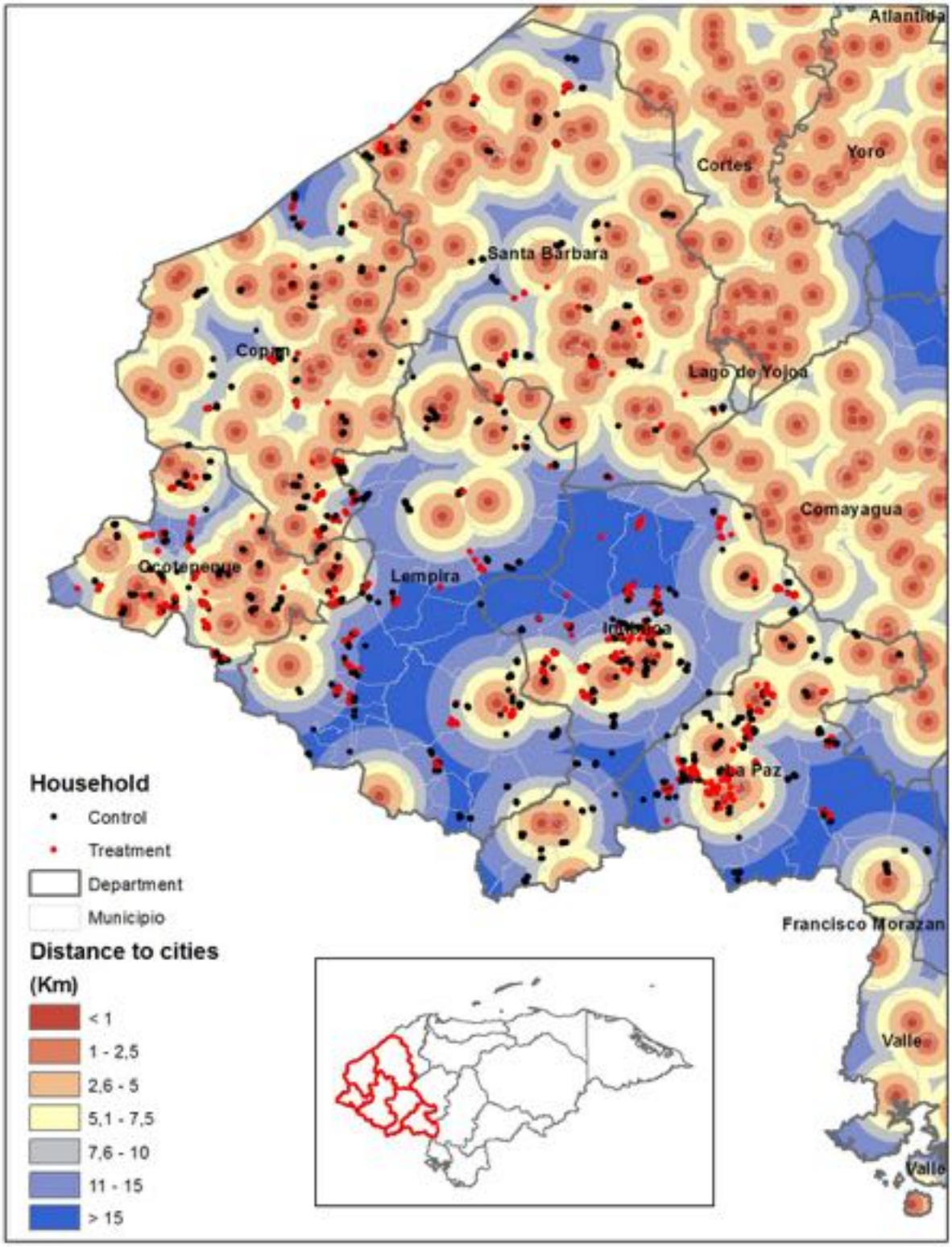


FIGURE 13 GEOGRAPHIC DISTRIBUTION AND DISTANCE TO CITIES



9 Appendix B – Sample Methodology

9.1 Sample Design

The sample designs to be used for these surveys are called "analytical survey designs," as contrasted to the "descriptive survey designs" used for most sample surveys. The purpose of a descriptive survey is to describe characteristics of a population of interest and various subpopulations. The purpose of an analytical survey is to develop detailed analytical models that describe the relationship of dependent variables to a variety of explanatory (independent) variables (including treatment variables). The principal objective of the surveys is to provide high precision for estimates of the double-difference estimate of program impact; i.e. the difference between the treatment and comparison groups, of the difference in income between the beginning and end of the evaluation period.

We have balanced the purpose of these 2 types of surveys in our calculation of sample size, given that representativeness at the department level desired and under these constraints we need to increase the precision of our impact estimates as much as possible. There are two major analysis objectives for the survey data. The first, and primary, objective is to obtain precise estimates of program impact, by means of double-difference estimates. The second is to investigate the relationship of program impact to a variety of explanatory variables, or "covariates." The main evaluation research design being used is a "pretest-posttest control-group design" with matching. In order to achieve the research objectives, it is desired to construct sample survey designs that (1) have substantial variation in the explanatory variables; (2) have a high degree of orthogonality among explanatory variables (that do not have a similar relationship to the dependent variable); and (3) have a high degree of correlation between members of the treatment and comparison groups (preferably by matching on a one-to-one basis, and secondarily by matching of probability distributions). Note that we are concerned here with selection of the sample of PSUs (caseríos or aldeas), not households within PSUs.

For the proposed designs, the probabilities of selection will be determined so that the expected number of sample items (PSUs) in various categories will be close to desired levels. Those levels will be determined to achieve desired levels of variation and orthogonality among explanatory variables, subject to the requirement that all probabilities of selection are known and nonzero (so that all population-of-interest units are subject to sampling) and the total sample size is as desired.

This procedure will produce a representative sample at the department level for the baseline survey using the most complete sample frame available, the 2001 census. The survey will be representative of poverty prevalence and/or undernourishment incidence in rural areas for each department where ACCESO is being implemented. A random over-sample of the beneficiaries will be added to the sample to improve the power of the sampling design in detecting the expected changes in the target population.

Given that the list of beneficiaries is incomplete we will likely increase the oversample of beneficiaries for the end line survey (and potentially the controls); effectively increasing the size of the treatment group and allowing us to explore possible heterogeneous effects that depend on the time that beneficiaries are exposed to the program.

The multistage stratified sampling design with and oversample will be as follows:

1) Stratify the sample frame by department
2) Select the number of primary sampling units (PSU) necessary for the sample to be representative of the department[30] by distributing the PSU's across urban-rural strata, and use demographic variables available in the census to balance the sample across gender, age groups, etc.
3) Randomly oversample ACCESO beneficiary households. Using the list of beneficiaries, we will randomly select beneficiary PSU's and within PSU select the beneficiary households that will form the treatment group. These households will be selected from the validated

[30] Potentially we could further stratify the sample between treated PSUs and non-treated PSUs which could improve the estimates across these groups. This will depend on the number of PSU that remain as non-treated, given that Acceso is spread out geographically (see Figure 14), there is the possibility that few PSU's have no beneficiaries.

list provided by Fintrac (i.e. list that of beneficiaries that comply with the poverty criteria).

4) Randomly select control PSU's around but far enough of beneficiary PSU's to insure a pool of controls that will not be treated by the end date of ACCESO.
5) Randomly select households within each PSU in the control group.
6) Calculate appropriate weights to adjust for the different probability of selection between treatment and controls.

The final sample size will also account for attrition among surveyed households given we will be implementing a three round panel survey. In addition this will allow us to follow a random sub-sample of the treatment households to insure that implementation efforts are not affected by the evaluation, in the sense that more effort could be placed by the implementers, among the households that are known to be in the evaluation sample to the detriment of other beneficiary households.

To arrive to a sample size that will comply with the above mentioned requirements we first simulate the effect of 30,000 households[31] exiting poverty under various scenarios to be able to bound the expected impact of the program and insure that the sample is large enough to detect these impacts.

Scenario 1

Uses the published poverty rates in each department[32] and calculates the change that would be observed after the exit of these households under the assumptions of:

- Number of households that exit poverty is proportional to the poverty share of the department

[31] This is the target number of households specified in Fintrac's proposal.
[32] All population numbers, poverty rates, malnutrition rates where obtain from the National Statistical Institute of Honduras (INE-Honduras) and can be found at http://www.ine.gob.hn/drupal/node/122

Scenario 2

Uses the published poverty rates in each department and calculates the change that would be observed after the exit of these households under the assumptions of:

- Number of households that exit poverty is proportional to the number of household participating in ACCESO to date. See Figure 14 for the geographic distribution of beneficiary households

Scenario 3

Assumes a 50% poverty rates for all department and calculates the change that would be observed after the exit of these households under the assumptions of:

- Number of households that exit poverty is proportional to the poverty share of the department

Scenario 4

Assumes a 50% poverty rates for all department and calculates the change that would be observed after the exit of these households under the assumptions of:

- Number of households that exit poverty is proportional to the number of household participating in ACCESO to date

These four scenarios are calculated under 3 more situations:

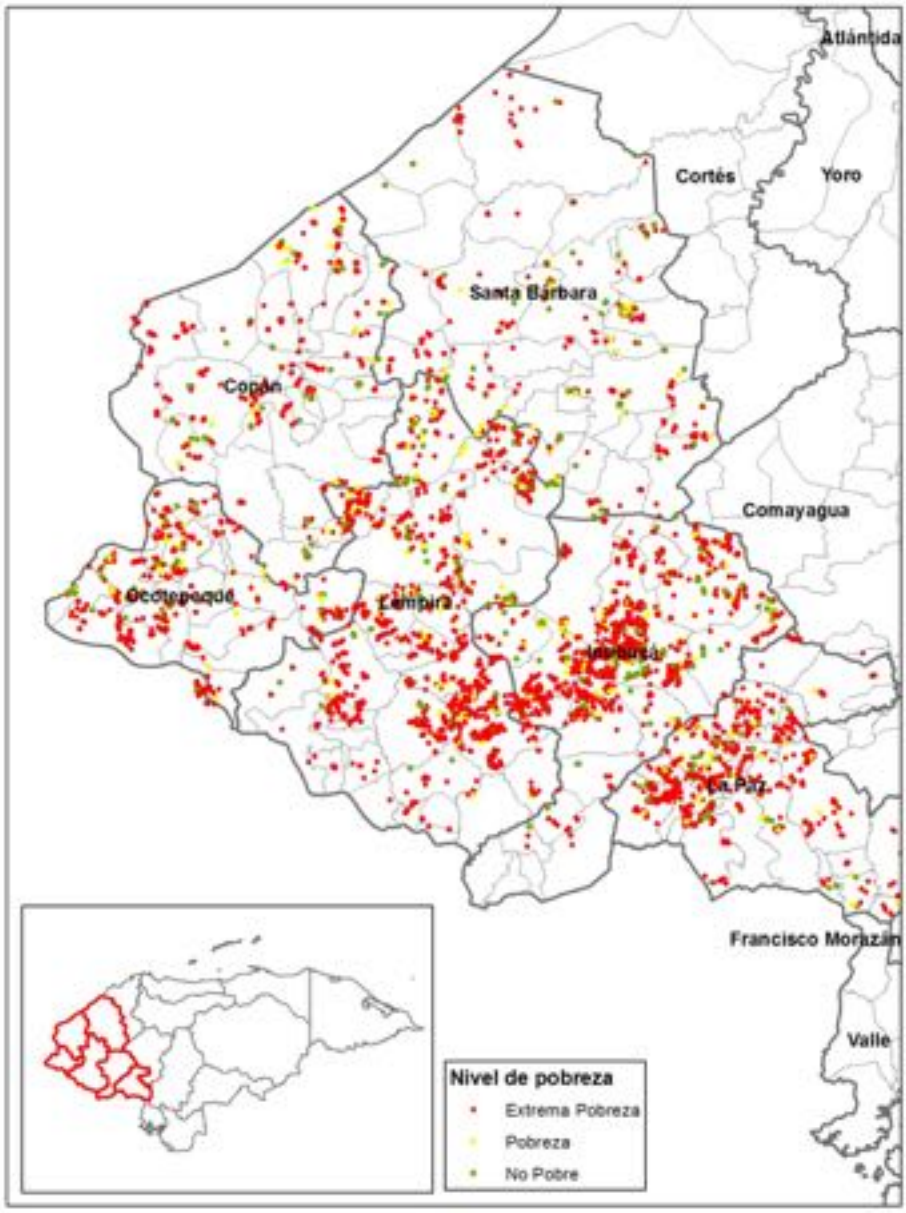
- No growth in population or poverty
- 3% increase in population and poverty
- 5% increase in population and poverty

The scenarios assumptions are summarized in Table 23 and results are presented in Table 24.

TABLE 23 SIMULATION SCENARIOS

	Poverty	Distribution of impact	No population growth	3% growth	5% growth
Scenario 1	Observed	Proportional to Poverty	✔	✔	✔
Scenario 2	Observed	Proportional to ACCESO	✔	✔	✔
Scenario 3	50%	Proportional to Poverty	✔	✔	✔
Scenario 4	50%	Proportional to ACCESO	✔	✔	✔

FIGURE 14 GEOGRAPHICAL DISTRIBUTION OF BENEFICIARY HOUSEHOLDS BY POVERTY CLASSIFICATION



Across the scenarios the aggregate effect (for all 6 departments) of taking 30,000 households out of poverty is a decrease between 4 and 12.4 percentage points in the poverty prevalence rate. Scenarios 3 and 4 illustrate that under lower levels of poverty prevalence the effects appear larger; this is because the target of the program is set on the number of households that are taken out of poverty, thus for lower initial levels a decrease of 30,000 households represents a higher percentage decrease in the poverty prevalence.

We will discuss in more detail scenarios 1 and 2, given that these scenarios are better informed by the data. In scenario 1, the principal assumption is that the beneficiary households are allocated to the program as a function of the share of poverty in each department. For example, the 6 departments have 199,525 household below the poverty line of which 41,566 live in Copán, so 41,566/199,525 or 22% of the beneficiaries are allocated to the department of Copán. This serves us to allocate more beneficiaries in department where the *number* of poor is greater, rather than where the poverty incidence (%) is greater. First, under an optimistic situation where there is no increase in population, the effect of the program is observed as a decrease of over 11 percentage points in the prevalence of poverty in each department, with Lempira experiencing the highest change at 13 percentage points. Under a likely[33] scenario, where population an poverty increase 3 percent , the aggregate effect is similar to the optimistic situation, with 11.5 percentage point decrease in the aggregate and over 11 percentage point at the department level. Under a conservative situation, with 5% growth in population and poverty the effect decreases to just over 4 percentage points in each department.

In scenario 2, the principal assumption is that the beneficiary households are allocated to the program in a way that is consistent with the beneficiary list that Fintrac has provided us to date. This serves us to allocate beneficiaries in department where the *Fintrac* has been more active, rather than where the number of poor is greater. The previous aggregate results do not change, given that the total number of poor that exit poverty remains unchanged; what changes is the distribution of the effects across the departments. First, under an optimistic situation where there is no increase in poverty, the effect of the program is observed as a decrease in the

[33] We call it "likely" given that from 2001 to 2010 rural poverty grew at a rate of 3% in Honduras (INE-Honduras)

prevalence of poverty in the range of 6.5 percentage points, for Santa Bárbara, to 22 percentage points in Ocotepeque. Under a likely scenario, where population and poverty increase 3 percent, the effects are around 0.25 percentage points lower relative to the optimistic situation. Under a conservative situation, with 5% growth in population and poverty the effects decrease considerably; the range now is between a 15 percentage points *decrease*, in Ocotepeque, to a 2 percentage points *increase*, in Santa Bárbara. This scenario shows us the importance of aggregate factors that might confound what we can observe in aggregate data. Similarly, a decrease in poverty due to other programs and/or improvements in aggregate/macroeconomic conditions would cause an attribution problem and/or bias the effect towards zero. These issues are addressed by our impact evaluation by using household level data and repeated measures (panel) to estimate the impact, which then can be used to extrapolate the effects to the aggregate.

We present the results of the sample size calculations below. The information from the simulation informs the power analysis that follows in that it allows us to gauge at what levels can will the sample be able to detect the expected changes.

The formulae are the following,

$$n = [1 + \rho(H - 1)] \frac{4Np(1-p)}{(N-1)\alpha^2 + 4p(1-p)}$$

where:

n is the sample size

N is the total population in the department

ρ is de intra-cluster correlation; we use 0.03[34]

H is the number of households in a cluster; we use 8 observations per cluster.

p is the proportion of interest, in this case the poverty rate in the department. In addition note that the function attains a maximum when p is 0.5, thus we also do the exercise in this case.

α is the type 1 error, which is set at 5%

[34] Using this value this value the design effect is 1.21. This value is common when calculating sample sizes for income measures in developing countries.

Furthermore, we calculate the minimum detectable effect (MDE), see Donner and Birkett N (1981) and Donner (1998), with the following,

$$MDE = \frac{2\sigma\left(Z_{\frac{\alpha}{2}} + Z_{\beta}\right)\sqrt{[1+\rho(H-1)]}}{\sqrt{n}}$$

β is the type 2 error, which is set at 10%, to get a 90% power and Z is the critical value of the normal distribution at the subscript specified.

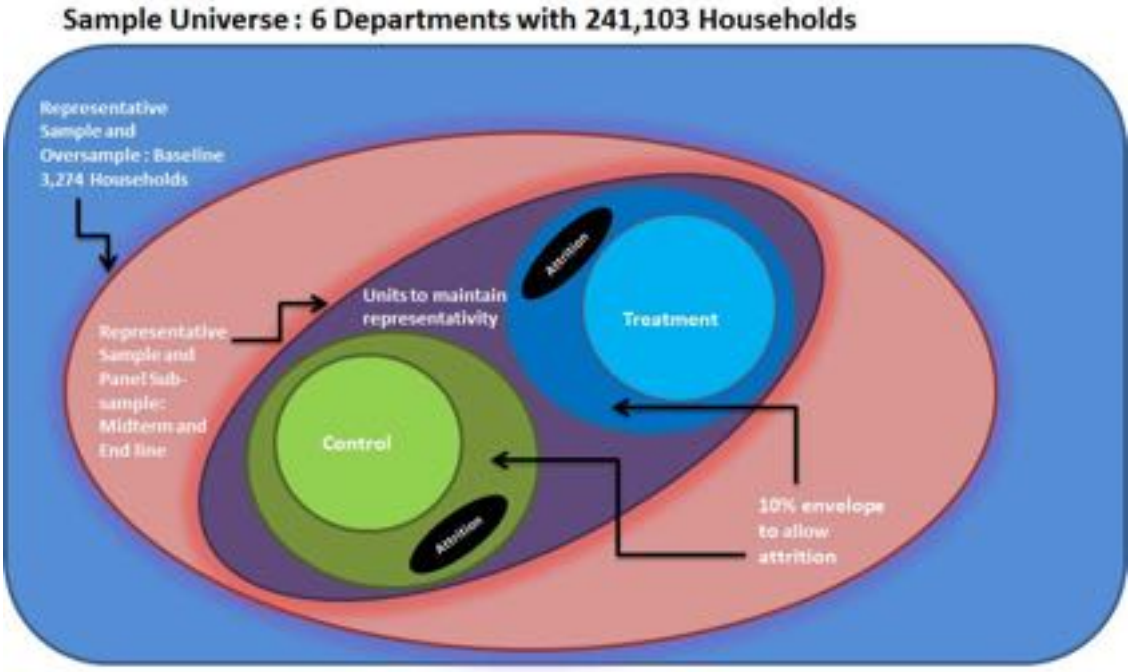
The results of the sample design are presented in Table 25. As mentioned above, we stratify the sample by department and select a representative sample for each department. The results of these calculations are in the columns under "Calculated". We then adjust the sample to have the same number of primary sample units (PSU); by selecting the greatest number of PSU's calculated. Then we increase the sample by 10% to account for attrition. Then we oversample the treatment group in 2 ways. First, we select a sample of 10% of the available beneficiary list, this is around 1,200 households, and we add these households to the calculated sample. This gives us a total sample of 570 households per department with an overall sample size of 3,417 households in 427 PSU's. In the other case, where we maximize the sample size by setting *p* to 0.5, we take the adjusted sample and instead of adding our oversample of treatment households we split the total number by allocating 200 households in each department to be selected from the beneficiary list, and the difference be selected from the sample frame as controls[35]. In this case we obtain a total sample of 3,220 households in 403 PSU's. In both cases, weights need to be used to account for the different probability of selection between treatment and controls when calculating aggregate measures.

The advantage of the first sample is that it can detect smaller differences across the treatment and control groups and is informed by the observed poverty rates. The benefit of the second strategy is that the sample size is maximized, thus allowing for precise estimates across different variables; but we need to split the sample among the treatment and control to keep the sample size within the budget. In the end both sample size calculations give us similar results, so that our

[35] In the previous case, i.e. using the observed poverty rates, we do not split the sample because the number of control units that remains is too small for a matching procedure.

calculations are not very sensitive to our assumptions. From these sample size calculations we will use the first results, and aimed to have a sample of 3,417 households in the baseline survey[36]. Finally, we present a graphical representation of the sample design in Figure 15.

FIGURE 15 GRAPHICAL REPRESENTATION OF THE SAMPLE DESIGN



[36] The sample size exercise was similarly done using undernourishment prevalence in each department. These rates are all around 50%, which increase the sample as mentioned below. The results of these calculations are presented in annex 4. In summary for the split sample we obtain 3,181 households and for the 'additive' sample we obtain 4,348 households. We note that these nutrition based sample are more precise than needed, since the expected effect for undernourishment is much larger (20% in selected areas expected change in Fintrac's proposal). The sample to detect a 20% decrease in malnutrition is 3,298 (unreported calculations) which is below our preferred size of 3,417, thus we can detect such a change if it were realized.
In addition we note that the simulations for undernourishment indicate that under optimistic assumptions, 70,000 children under 5 years need to exit undernourishment for such a change to be observed. This could be very challenging.

TABLE 24 SIMULATION OF A DECREASE OF 30,000 HOUSEHOLDS IN ACCESO'S AREA OF INFLUENCE

	Census					Optimistic			Likely			Conservative		
						No population change			Assuming 3% poor population growth			Assuming 5% poor population growth		
	Households	% Poor	No. Poor	Shares	Effect	No. Poor	% Poor	% Change	No. Poor	% Poor	% Change	No. Poor	% Poor	% Change
Scenario 1														
Copán	53,168	78%	41,566	21%	-6,250	35,316	66.4%	-11.8%	36,563	66.8%	-11.4%	37,395	73.8%	-4.3%
Intibucá	30,503	86%	26,120	13%	-3,927	22,193	72.8%	-12.9%	22,977	73.1%	-12.5%	23,499	80.9%	-4.7%
La Paz	27,510	78%	21,526	11%	-3,237	18,290	66.5%	-11.8%	18,935	66.8%	-11.4%	19,366	73.9%	-4.3%
Lempira	43,734	86%	37,710	19%	-5,670	32,040	73.3%	-13.0%	33,171	73.6%	-12.6%	33,925	81.5%	-4.8%
Ocotepeque	20,161	79%	15,955	8%	-2,399	13,556	67.2%	-11.9%	14,035	67.6%	-11.6%	14,354	74.8%	-4.4%
Santa Bárbara	66,027	86%	56,648	28%	-8,517	48,130	72.9%	-12.9%	49,830	73.3%	-12.5%	50,963	81.0%	-4.8%
Total	**241,103**	**82%**	**199,525**		**-30,000**	**169,525**	**70.3%**	**-11.9%**	**175,511**	**70.7%**	**-11.5%**	**179,502**	**78.2%**	**-4.0%**
Scenario 2														
Copán	53,168	78%	41,566	16%	-4,854	36,712	69.0%	-9.1%	37,959	69.3%	-8.9%	38,790	76.6%	-1.6%
Intibucá	30,503	86%	26,120	17%	-5,230	20,890	68.5%	-17.1%	21,674	69.0%	-16.6%	22,196	76.4%	-9.2%
La Paz	27,510	78%	21,526	14%	-4,179	17,347	63.1%	-15.2%	17,993	63.5%	-14.7%	18,423	70.3%	-7.9%
Lempira	43,734	86%	37,710	23%	-7,009	30,701	70.2%	-16.0%	31,832	70.7%	-15.6%	32,586	78.2%	-8.0%
Ocotepeque	20,161	79%	15,955	15%	-4,453	11,502	57.1%	-22.1%	11,981	57.7%	-21.4%	12,300	64.1%	-15.1%
Santa Bárbara	66,027	86%	56,648	14%	-4,274	52,374	79.3%	-6.5%	54,073	79.5%	-6.3%	55,206	87.8%	2.0%
Total	**241,103**	**82%**	**199,525**		**-30,000**	**169,525**	**70.3%**	**-11.9%**	**175,511**	**70.7%**	**-11.5%**	**179,502**	**78.2%**	**-4.0%**

Scenario 3														
Copán	53,168	**50%**	26,584	22%	-6,616	19,968	37.6%	-12.4%	20,766	37.9%	-12.1%	21,298	42.1%	-7.9%
Intibucá	30,503	**50%**	15,252	13%	-3,795	11,456	37.6%	-12.4%	11,914	37.9%	-12.1%	12,219	42.1%	-7.9%
La Paz	27,510	**50%**	13,755	11%	-3,423	10,332	37.6%	-12.4%	10,745	37.9%	-12.1%	11,020	42.1%	-7.9%
Lempira	43,734	**50%**	21,867	18%	-5,442	16,425	37.6%	-12.4%	17,081	37.9%	-12.1%	17,519	42.1%	-7.9%
Ocotepeque	20,161	**50%**	10,081	8%	-2,509	7,572	37.6%	-12.4%	7,874	37.9%	-12.1%	8,076	42.1%	-7.9%
Santa Bárbara	66,027	**50%**	33,014	27%	-8,216	24,798	37.6%	-12.4%	25,788	37.9%	-12.1%	26,449	42.1%	-7.9%
Total	**241,103**	**50%**	**120,552**		**-30,000**	**90,552**	**37.6%**	**-12.4%**	**94,168**	**37.9%**	**-12.1%**	**96,579**	**42.1%**	**-7.9%**
Scenario 4														
Copán	53,168	**50%**	26,584	16%	-4,854	21,730	40.9%	-9.1%	22,527	41.1%	-8.9%	23,059	45.5%	-4.5%
Intibucá	30,503	**50%**	15,252	17%	-5,230	10,021	32.9%	-17.1%	10,479	33.4%	-16.6%	10,784	37.1%	-12.9%
La Paz	27,510	**50%**	13,755	14%	-4,179	9,576	34.8%	-15.2%	9,988	35.3%	-14.7%	10,263	39.2%	-10.8%
Lempira	43,734	**50%**	21,867	23%	-7,009	14,858	34.0%	-16.0%	15,514	34.4%	-15.6%	15,952	38.3%	-11.7%
Ocotepeque	20,161	**50%**	10,081	15%	-4,453	5,627	27.9%	-22.1%	5,930	28.6%	-21.4%	6,131	31.9%	-18.1%
Santa Bárbara	66,027	**50%**	33,014	14%	-4,274	28,740	43.5%	-6.5%	29,730	43.7%	-6.3%	30,390	48.3%	-1.7%
Total	**241,103**	**50%**	**120,552**		**-30,000**	**90,552**	**37.6%**	**-12.4%**	**94,168**	**37.9%**	**-12.1%**	**96,579**	**42.1%**	**-7.9%**

TABLE 25 SAMPLE SIZE CALCULATIONS

			Calculated			Adjusted			Oversample			Final		
Department	**Households**	**Poverty**	**Households**	**PSU**	**MDD %**	**Households**	**PSU**	**MDD %**	**10% Attrition**	**Treatment**	**Controls**	**Households**	**PSU**	**MDD %**
Poverty at actual and adding oversample of T														
Copán	53,168	78.4	329	42	16.2%	336	42	16.1%	34	200	336	570	71	12.3%
Intibucá	30,503	83.0	237	30	16.2%	336	42	13.6%	34	200	336	570	71	10.5%
La Paz	27,510	78.2	327	41	16.3%	336	42	16.0%	34	200	336	570	71	12.3%
Lempira	43,734	84.3	229	29	16.2%	336	42	13.4%	34	200	336	570	71	10.3%
Ocotepeque	20,161	78.2	316	40	16.3%	336	42	15.8%	34	200	336	570	71	12.1%
Santa Bárbara	66,027	85.6	236	30	16.2%	336	42	13.6%	34	200	336	570	71	10.4%
Total	**241,103**	**81**	**1,674**	**212**	**6.7%**	**2,016**	**252**	**6.1%**	**201**	**1,200**	**2,016**	**3,417**	**427**	**4.7%**
Poverty at 50% and splitting sample T/C														
Copán	53,168	50.0	481	61	16.3%	488	61	16.1%	49	200	288	537	67	15.4%
Intibucá	30,503	50.0	478	60	16.3%	488	61	16.1%	49	200	288	537	67	15.4%
La Paz	27,510	50.0	478	60	16.3%	488	61	16.1%	49	200	288	537	67	15.4%
Lempira	43,734	50.0	480	60	16.3%	488	61	16.1%	49	200	288	537	67	15.4%
Ocotepeque	20,161	50.0	475	60	16.4%	488	61	16.1%	49	200	288	537	67	15.4%
Santa Barbara	66,027	50.0	482	61	16.2%	488	61	16.1%	49	200	288	537	67	15.4%
Total	**241,103**	**50**	**2,874**	**362**	**6.6%**	**2,928**	**366**	**6.6%**	**292**	**1,200**	**1,728**	**3,220**	**403**	**6.3%**

9.2 Power Analysis

Given this sample we explore the power of the design under different types of indicators and minimum effect sizes. We present results using the minimum calculated clusters (212) and our adjusted sample (427). Figure 16 shows the minimum detectable effect for each power level under the assumptions of random assignment of clusters and 3 observations in time (1 baseline and 2 follow-ups). This figure addresses the impact on continuous outcomes, such as expenditures, that is detectable given our sample. For our preferred sample we can detect a 12% difference[37] between the treatment and control group with 80% power, and 14% difference between the groups with 90% power. For the smaller sample, the detectable difference 18% at 80% power and 20% at 90% power.

In Figure 17[38] we present similar results for the differences detectable at baseline. For our preferred sample we can detect a 10% difference between the treatment and control group with 80% power, and 12% difference between the groups with 90% power[39].

Figure 18 and Figure 19 show the power analysis for binary outcomes, such as the prevalence of poverty in each group. Figure 18 shows the number of clusters (of 8 households) necessary to attain a level of power, under the assumptions that the prevalence of poverty in the control group is 82% and that the expected prevalence of poverty in the treatment group is 74%, for a difference of 8%. The figures shows that 450 clusters are needed to attain a 90% power under these assumptions and that 340 clusters are needed to attain an 80% power. Our sample will only have 427 clusters, thus we further explore the level of power we have for binary outcomes with this sample.

[37] In this section all differences are standardized, i.e. the observed differences are divided by their standard deviations. For example, a 4.7% detectable difference presented in the sample size calculation is approximately equivalent to a 12.2% standard difference.

[38] Figures are obtained using software developed by Raudenbush and al. 2011)

[39] Power is higher at baseline (given a MDE) because variability of the unconstrained estimate is lower. For example, given one cross section we have that the variance of the difference between the groups is the sum of the variances, call this A; assume that in the follow up the variance is the same, then the variance of the difference in difference is 2A, which is larger than A. This does not imply that more data or panel data decreases the reliability of an estimate; it means that measurement error needs to be addressed in panel studies, and that the benefits of using within household variation and covariates increase the precision of the estimates enough to offset the measurement error problem.

Finally we present the power of our sample to detect difference in the poverty prevalence across groups, fixing the poverty rate in the control group at 82% and allowing the expected poverty rate in the treatment group to vary. For our adjusted sample, 73.5% prevalence in the treatment group, for an 8.5% difference, can be detected at 90 % level; at 80% power we can detect a 7% difference in the prevalence rates.

In summary, the results from the power analysis show that the sample design is well powered to detected economically significant difference across beneficiaries and non-beneficiaries

FIGURE 16 STANDARDIZED EFFECT SIZE (MDE) VS. POWER UNDER 3 SURVEY WAVES FOR CONTINUOUS OUTCOMES

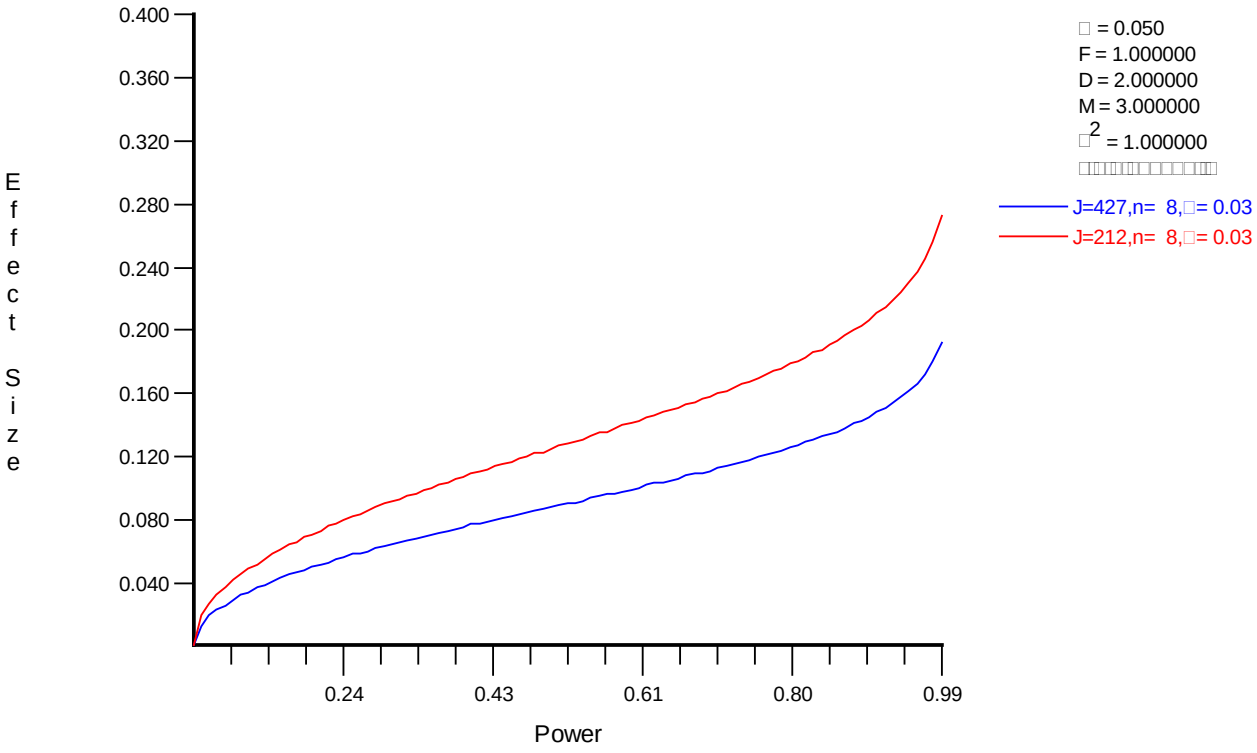


FIGURE 17 STANDARDIZED EFFECT SIZE (MDE) VS. POWER AT BASELINE FOR CONTINUOUS OUTCOMES

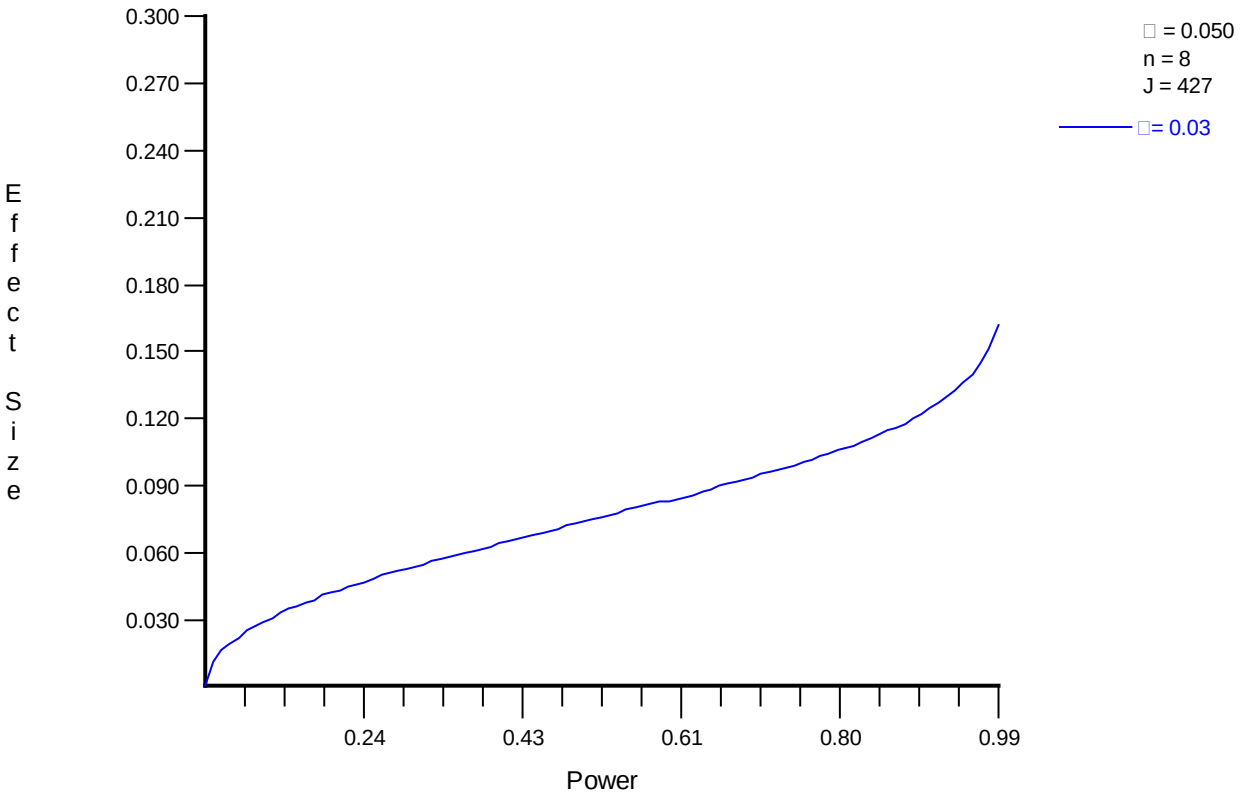


FIGURE 18 POWER VS. NUMBER OF CLUSTER VS. POWER FOR BINARY OUTCOME

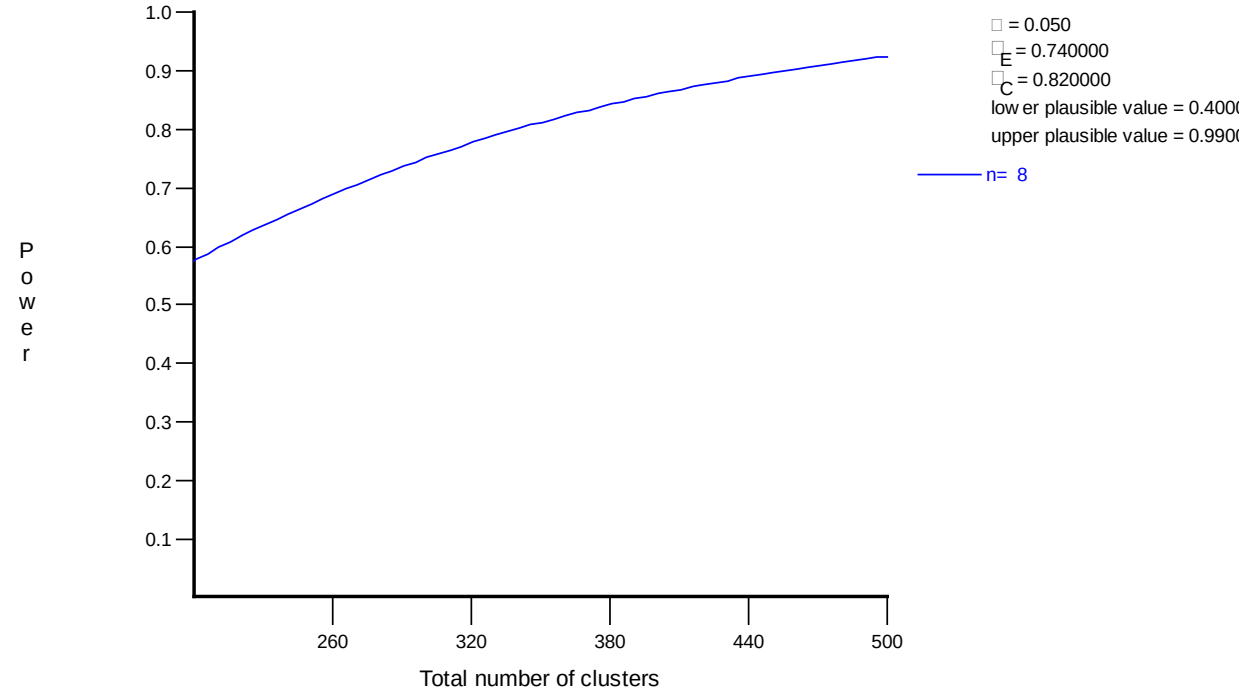
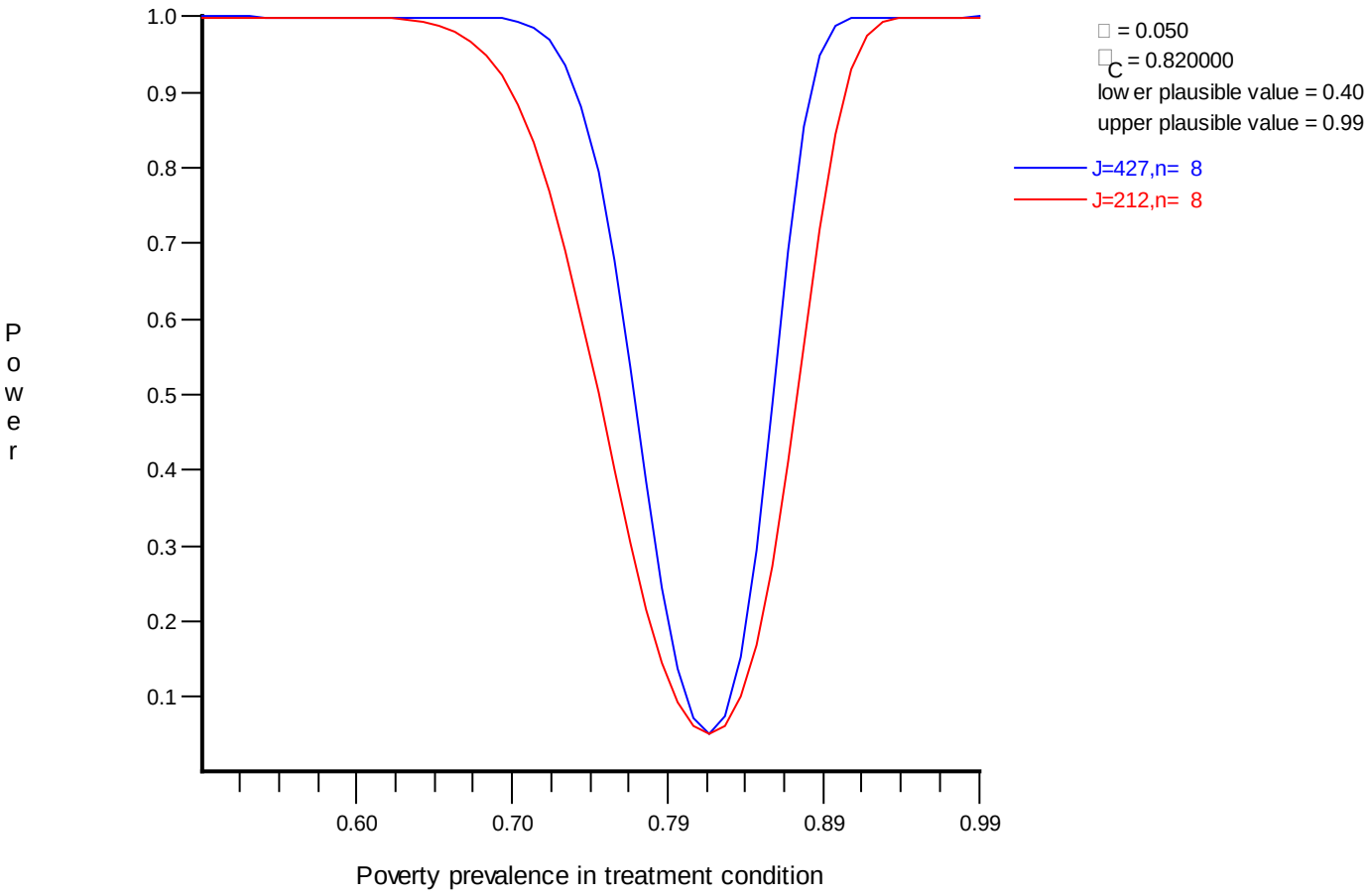


FIGURE 19 POWER VS. PREVALENCE OF POVERTY IN TREATMENT GROUP, BINARY OUTCOME



10 Appendix C - ZOI Performance Monitoring Indicator

In this appendix we present the performance monitoring indicators computed from the baseline survey. The indicators are disaggregated by sex, gendered household type, location, etc., as delineated in the Feed the Future guidelines.

TABLE 26 ZOI PERFORMANCE INDICATORS: TOTAL AND BY SEX

	Total		Sex			
			Male		Female	
	Number	%	Number	%	Number	%
Percentage of **Households** from sample living on <$1.25/day (2005 PPP US$)	1,071	32.20				
Percentage of **People** from sample living on <$1.25/day (2005 PPP US$)	6,992	41.23				
Average per capita expenditures (in USD) of sample (2011 US$, Annual)	565.68					
Average per capita per day expenditures in 2005 PPP inflated to 2010 US prices	2.17					
Percent of children 0-24 months of age that is underweight	70	10.9	43	13.69%	27	8.23%
Percent of children 0-59 months of age that is underweight	223	14.77	119	15.87%	104	13.68%
Percentage of children 0-59 months of age in sample that is stunted	626	40.23	328	42.21%	298	38.25%
Percentage of children 0-59 months of age in sample that is wasted	20	1.35	10	1.37%	10	1.32%
Percentage of women 15-49 years of age in sample that is underweight	192	7.05				
Percentage of households in sample with moderate to severe hunger	107	3.37				
Percentage of children 6-23 months in sample receiving a minimum acceptable diet	414	47.37	207	47.59	207	47.15
Mean number of food groups consumed by women 15-49 years in the sample	3.4					
Percentage of children 0-5 months of age in sample who are exclusively breastfed	98	71.53	49	74.24	49	69.01
Percent of women 15-49 years in sample with anemia	298	11.02				
Percent of children 6-59 months in sample with anemia	327	23.8	173	24.86%	154	22.75%

TABLE 27 ZOI PERFORMANCE INDICATORS: POPULATION TOTALS

	Total		Sex			
			Male		Female	
	Number	%	Number	%	Number	%
Total population of children 0-59 months of age in zone of influence	207,404		106,158		101,245	
Total population in zone of influence	1,523,044					
Total population of Households in zone of influence	289,726					
Total population of women 15-49 years of age in zone of influence	336,756					
Total population of households in zone of influence	289,726					
Total population of children 0-24 months in zone of influence	87,417		46,013		41,403	
Total population of children 6-23 months in zone of influence	64,496		33,898		30,598	
Total population of children 0-5 months of age in zone of influence	19,079		10,112		8,967	
Total population of children 6-59 months in zone of influence	188,325		96,047		92,278	

**Population Totals are estimated using the 2005-06 DHS survey and updated census population numbers.*

TABLE 28 ZOI PERFORMANCE INDICATORS: BY GENDERED HH TYPE

	Household Type							
	Adult Female, No Male		Adult Male, No Female		Male and Female Adults		No Adults	
	Number	%	Number	%	Number	%	Number	%
Percentage of **Households** from sample living on <$1.25/day (2005 PPP US$)	69	21.17	9	7.32	993	34.52	0	0
Percentage of **People** from sample living on <$1.25/day (2005 PPP US$)	336	29.68	31	11.40	6,625	42.59	0	0
Average per capita expenditures (in USD) of sample (2011 US$, Annual)	731.18		1,005.24		528.14			
Average per capita per day expenditures in 2005 PP inflated to 2010 US prices	2.81		3.86		2.03			

	Household Type							
	Adult Female, No Male		Adult Male, No Female		Male and Female Adults		No Adults	
	Number	%	Number	%	Number	%	Number	%
Percentage of households in sample with moderate to severe hunger	19	5.57%	3	2.21%	85	3.15%	0	0.00%
Total population of in zone of influence	130,387	8.56%	34,215	2.25%	1,357,370	89.12%	1,072	0.07%
Total population of Households in zone of influence	34,829	12.02%	17,659	6.10%	236,599	81.66%	638	0.22%

**Population Totals are estimated using the 2005-06 DHS survey and updated census population numbers.*

TABLE 29 ZOI PERFORMANCE INDICATORS: BY LOCATION

	Location			
	Urban		Rural	
	Number	%	Number	%
Mean number of food groups consumed by women 15-49 years in the sample	3.7		3.3	

TABLE 30 ZOI PERFORMANCE INDICATORS: BY PHYSIOLOGICAL STATUS

	Physiological status			
	Pregnant		Non-pregnant	
	Number	%	Number	%
Percent of women 15-49 years in sample with anemia	22	12.94%	276	10.90%
Total population of women 15-49 years of age in zone of influence	17,339	5.15%	319,417	94.85%

**Population Totals are estimated using the 2005-06 DHS survey and updated census population numbers.*

TABLE 31 ZOI PERFORMANCE INDICATORS: WOMEN EMPOWERMENT IN AGRICULTURE INDEX

5DE Index	Women	Men
DISEMPOWERED HEADCOUNT (H_20p)	0.685	0.399
AVERAGE INADEQUACY SHARE (A_20p)	0.387	0.311
5 DOMAINS DISEMPOWERMENT INDEX (M0_20p)	0.265	0.124
5 DOMAINS EMPOWERMENT INDEX (EA_20P)	0.735	0.876

	Dual-HH
PARITY INADEQUACY HEAD COUNT (H_GPI)	0.581
CENSORED PARITY INADEQUACY SCORES AVERAGE	0.218
GENDER DISPARITY INDEX (PI)	0.126
GENDER PARITY INDEX (GPI)	0.874

	Women	Men
5 DOMAINS EMPOWERMENT INDEX (EA_20P)	0.735	0.876
GENDER PARITY INDEX (GPI)	0.874	
EMPOWERMENT IN AGRICULTURE INDEX	0.749	0.8758

11 Appendix D – Decomposition of Women Empowerment Index in Agriculture

TABLE 32 DECOMPOSITION OF 5DE EMPOWERMENT INDEX

Honduras: 5DE Decomposed by Dimension and Indicator (Empowerment)										
Statistics	PRODUCTION		RESOURCES			INCOME	LEADERSHIP		TIME	
	INPUT IN PRODUCTIVE DECISIONS	AUTONOMY IN PRODUCTION	OWNERSHIP	PURCHASE, SALE OR TRANSFER OF ASSETS	ACCESS TO AND DECISIONS ON CREDIT	CONTROL OVER USE OF INCOME	GROUP MEMBERSHIP	SPEAK IN PUBLIC	WORKLOAD BURDEN	LEISURE TIME
WOMEN										
Censored headcount	88.4%	92.4%	88.7%	50.4%	34.0%	66.7%	67.1%	74.1%	74.6%	89.3%
% Contribution	1.6%	1.0%	1.0%	4.5%	6.0%	9.1%	4.5%	3.5%	3.5%	1.5%
Contribution	0.088	0.092	0.059	0.034	0.023	0.133	0.067	0.074	0.075	0.089
% Contr. by dimension	2.6%		11.5%			9.1%	8.0%		4.9%	
MEN										
Censored headcount	83.5%	94.0%	93.3%	74.5%	62.1%	98.1%	77.1%	88.2%	92.4%	91.4%
% Contribution	1.9%	0.7%	0.5%	1.9%	2.9%	0.4%	2.6%	1.3%	0.9%	1.0%
Contribution	0.084	0.094	0.062	0.050	0.041	0.196	0.077	0.088	0.092	0.091
% Contr. by dimension	2.6%		5.3%			0.4%	4.0%		1.9%	

Data Source: IFPRI-FTF Honduras Impact Evaluation Survey 2012(Baseline)

FIGURE 20 CONTRIBUTION OF EACH INDICATOR TO 5DE EMPOWERMENT INDEX

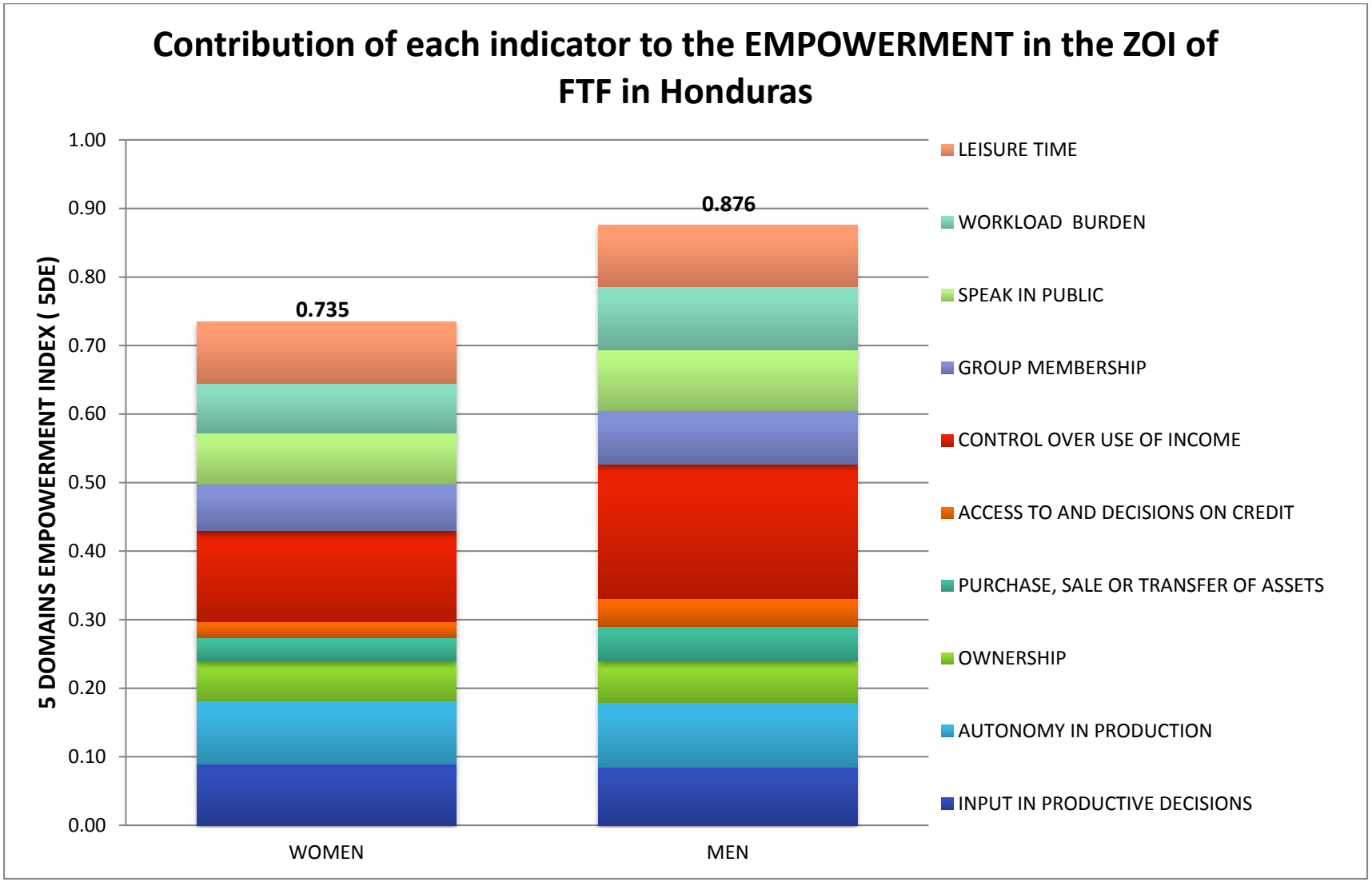


FIGURE 21 PROPORTION OF WOMEN ACHIEVING EMPOWERMENT BY INDICATOR

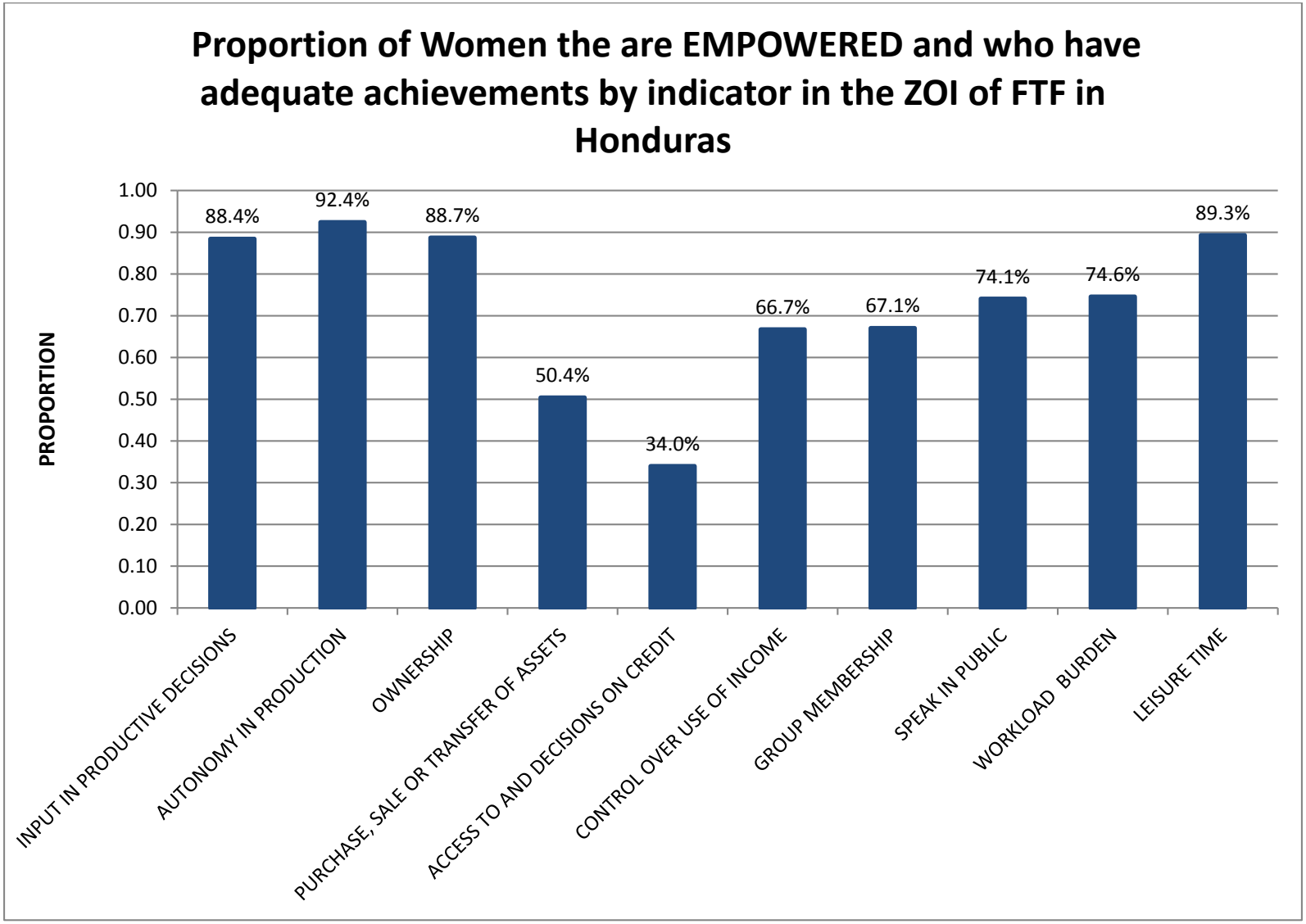


TABLE 33 DECOMPOSITION OF 5DE DISEMPOWERMENT INDEX

Honduras: M0=1-5DE Decomposed by Dimension and Indicator (DISEMPOWERMENT)										
Statistics	PRODUCTION		RESOURCES			INCOME	LEADERSHIP		TIME	
	INPUT IN PRODUCTIVE DECISIONS	AUTONOMY IN PRODUCTION	OWNERSHIP	PURCHASE, SALE OR TRANSFER OF ASSETS	ACCESS TO AND DECISIONS ON CREDIT	CONTROL OVER USE OF INCOME	GROUP MEMBERSHIP	SPEAK IN PUBLIC	WORKLOAD BURDEN	LEISURE TIME
WOMEN										
Censored headcount	11.6%	7.6%	11.3%	49.6%	66.0%	33.3%	32.9%	25.9%	25.4%	10.7%
% Contribution	4.4%	2.9%	2.8%	12.5%	16.6%	25.1%	12.4%	9.8%	9.6%	4.0%
Contribution	0.012	0.008	0.008	0.033	0.044	0.067	0.033	0.026	0.025	0.011
% Contr. by dimension	7.2%			31.9%		25.1%	22.2%		13.6%	
MEN										
Censored headcount	16.5%	6.0%	6.7%	25.5%	37.9%	1.9%	22.9%	11.8%	7.6%	8.6%
% Contribution	13.3%	4.8%	3.6%	13.7%	20.4%	3.1%	18.4%	9.5%	6.1%	7.0%
Contribution	0.016	0.006	0.004	0.017	0.025	0.004	0.023	0.012	0.008	0.009
% Contr. by dimension	18.1%			37.7%		3.1%	28.0%		13.1%	

Data Source: IFPRI-FTF Honduras Impact Evaluation Survey 2012(Baseline)

FIGURE 22 CONTRIBUTION OF EACH INDICATOR TO 5DE DISEMPOWERMENT INDEX

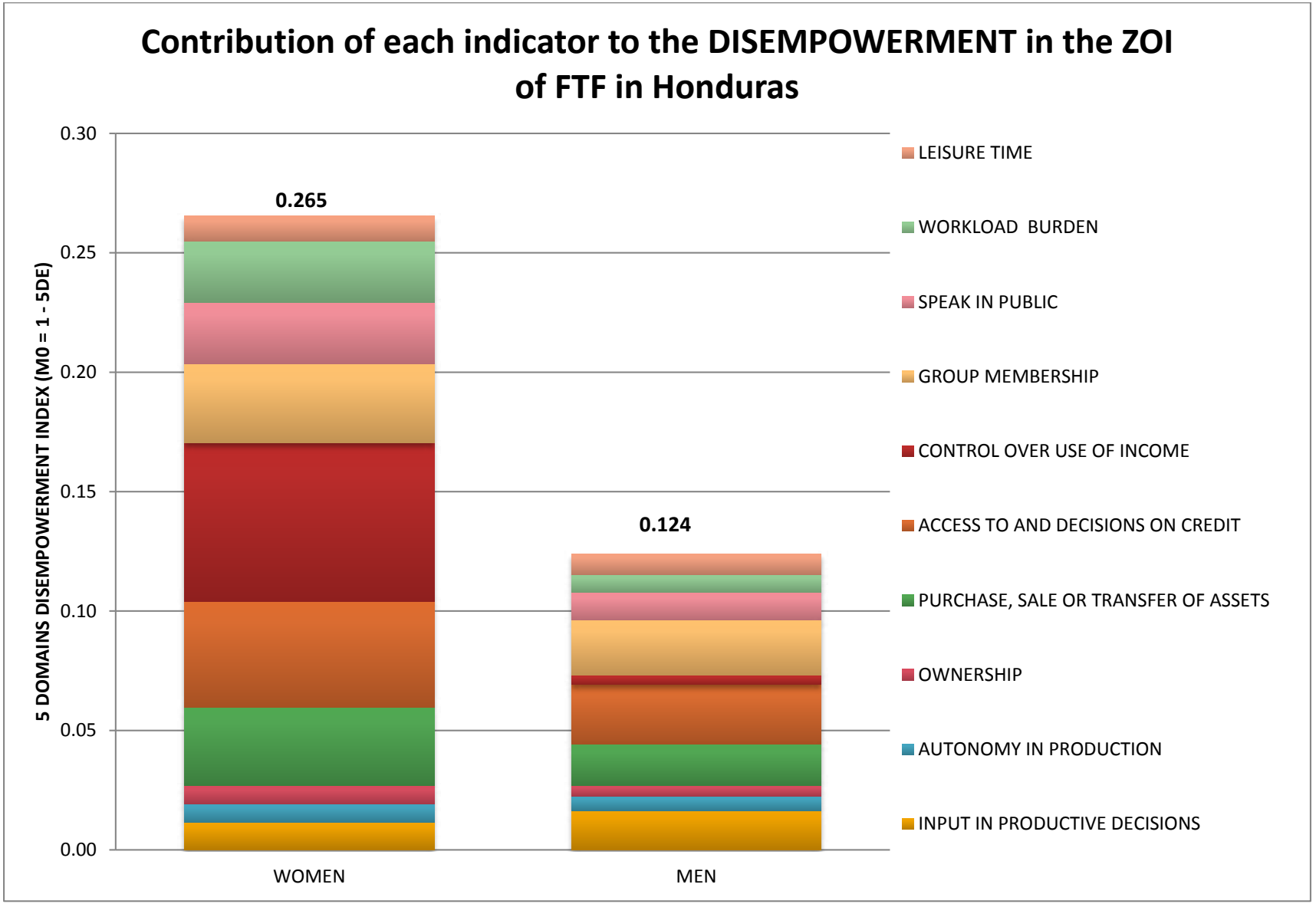


FIGURE 23 PROPORTION OF WOMEN NOT EMPOWERED BY INDICATOR

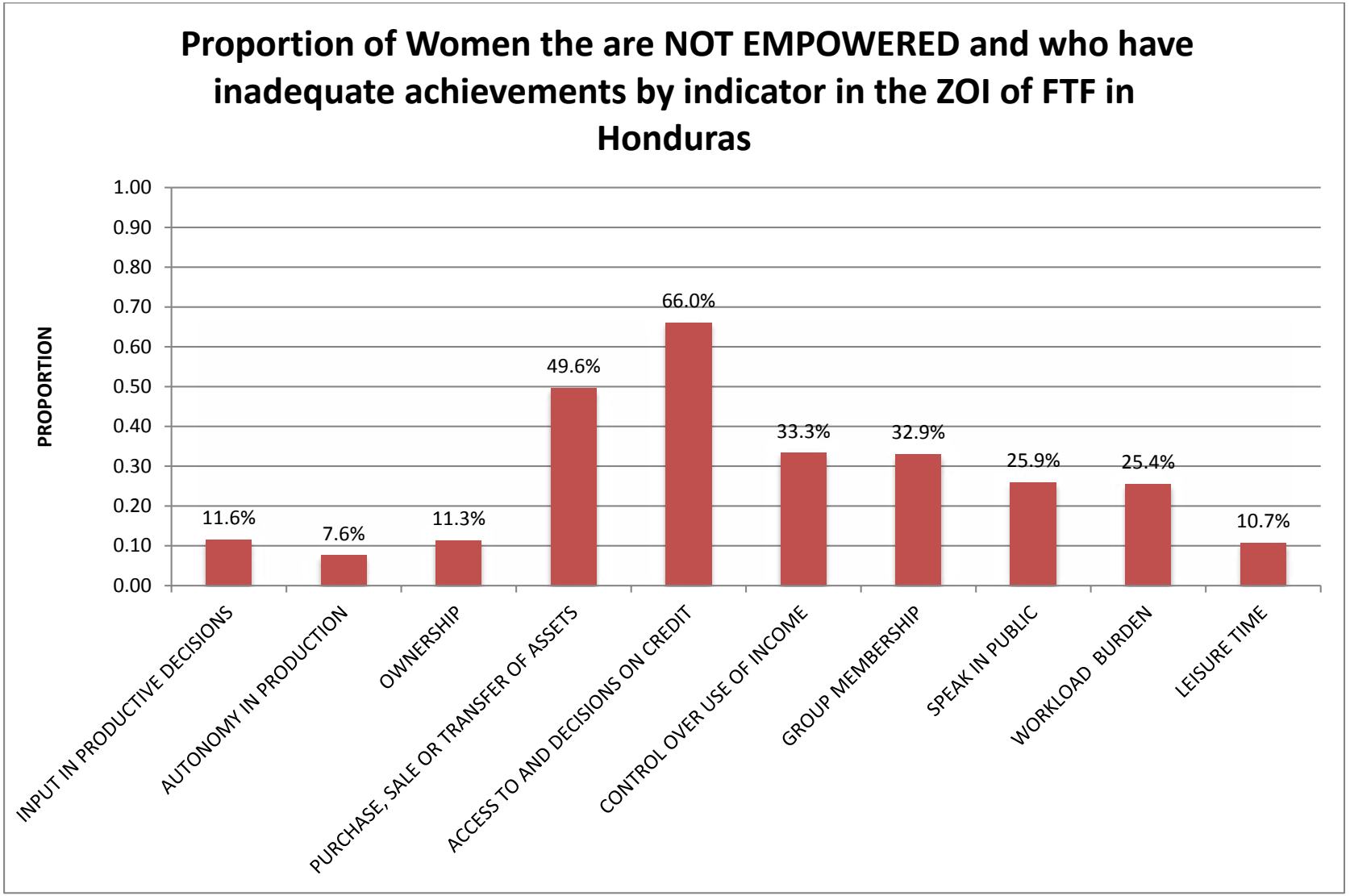


TABLE 34 CENSORED HEADCOUNTS FROM 5DE INDEX

Censored headcount from 5DE Index		Baseline Value
Domain	**Indicator**	**% of Females achieving indicator**
PRODUCTION	Input in productive decisions	88.43%
	Autonomy in production	92.42%
RESOURCES	Ownership of assets	88.70%
	Purchase, sale, or transfer of assets	50.41%
	Access to and decisions on credit	33.96%
INCOME	Control over use of income	66.71%
LEADERSHIP	Group member	67.05%
	Speaking in public	74.09%
TIME	Workload	74.56%
	Leisure	89.31%

Data Source: IFPRI-FTF Honduras Impact Evaluation Survey 2012(Baseline)