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LIVELIHOODS IN ZIMBABWE

Evaluation of food security and strengthening livelihood options

Credit: Ntando Ndebele/Oxfam

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EXECUTIVE SUMMARY

Oxfam GB's Global Performance Framework is part of the organisation's effort to better understand and communicate its effectiveness, as well as enhance learning across the organisation. Under this Framework, a small number of completed or mature projects are selected at random each year for an evaluation of their impact, known as an 'Effectiveness Review'. The Food Security and Livelihood Programme in Zimbabwe was one of those selected for an Effectiveness Review in the 2013/14 financial year.

The project's overall objective was to contribute to the eradication of extreme poverty and hunger among the poor and vulnerable in Midlands and Masvingo provinces of Zimbabwe. It aimed to do this by enhancing livelihood options for households from selected communities in 15 wards across three districts in these provinces. The project aimed to directly benefit up to 24,500 people across the three target districts through three key interventions:

- Summer agricultural inputs together with conservation agriculture training.
- Small livestock support.
- Development of communal market garden linkages.

The project activities were implemented from 2010 to 2014 by Oxfam in conjunction with two local partner organisations – Batanai HIV & AIDS Service Organisation (BHASO) and Midlands Aids Caring Organisation (MACO).

Evaluation approach

The Effectiveness Review used a quasi-experimental evaluation design to assess the impact of the project activities in November and December 2013, shortly before the project's end. A household survey was carried out with 494 of the households directly supported by the project, and with 536 households from nearby communities where the project had not been implemented, for comparison purposes. At the analysis stage, the statistical tools of propensity-score matching and multivariate regression were used to control for apparent baseline differences between project participant households and comparison households, to increase confidence when making assessments of the project's impact.

Results

The review found evidence that the Food Security and Livelihood Programme has positively affected supported households in several important livelihood and food security characteristics. There is evidence of positive change through the different steps of the project logic, from adoption of improved agricultural practices, to increased crop production and sales, diversification in livelihoods activities, and increased overall household income and food security.

The differences in outcomes between the three intervention groups are instructive. There appear to be large positive impacts among those supported by the project's basic intervention (agricultural inputs and training in conservation agriculture), who produced more than double the quantity of crops than corresponding households in the comparison group. The participants in this component of the project generated much larger income from crop sales than did the comparison households, had a household income approximately 19 per cent higher, and were also eating a more diverse diet. However, there was less evidence among this group of an improvement in food security, and no indication of a change in terms of wealth indicators (asset ownership and housing conditions).

Key results of this Effectiveness Review

Outcome area	Overall	Inputs and conservation agriculture group	Small livestock group	Communal market-garden linkages group
Adoption of improved agricultural practices	Yes	Yes	Yes	Yes
Increase in number of crops cultivated	Yes	Yes	Yes	Yes
Increase in cereal crop production	Yes	Yes	Yes	Yes
Increase in vegetable production	Yes	Yes	Yes	Yes
Increase in livelihood activities	Yes	No	Yes	Yes
Increased household income	Yes	Yes	Yes	Yes
Improvement in wealth indicators	Yes	No	Yes	Yes
Increased food security and dietary diversity	Yes	Yes	Yes	Yes

The livestock support and market-garden participants – who received inputs and training in conservation agriculture as well as the specific support provided under those two components of the project – were found to have generated even greater gains in agricultural production and sales, and in overall household income. Their increased engagement in livestock rearing and market gardening meant that they had increased the diversification of their income sources over the project's lifetime. Households in the market-garden intervention group demonstrated particularly positive results, with an estimated average income increase of 40 per cent, significant changes in wealth indicators, and improved food security and dietary diversity.

Overall, therefore, these findings demonstrate consistent and impressive evidence that the project has successfully resulted in positive changes in terms of the household-level outcomes it was targeting.

Programme learning considerations

Continue to strengthen and build on the success of the project in delivering a 'basket' of interventions

This Effectiveness Review offered an opportunity to not just examine the effectiveness of the project overall, but also the difference in project impact across three interventions. As such, the review has highlighted the greatest project impact among those participants who received agricultural inputs and conservation agriculture, *as well as* livestock or communal gardening support. The programme and country team should give this due consideration ahead of future project activity, and seek to roll out, where appropriate, a 'basket' of evidence-based interventions among supported households.

Strengthen the market-linkage work among the communal market-garden project participants

While there is strong evidence of project impact among the market-garden participants, it was interesting to note that only 10 per cent of these producers reported selling their produce to a cooperative. This seems to highlight an opportunity to strengthen this aspect of the project. The programme and country team should consider how this can be improved among the project participants, as well as for future market-development projects.

1 INTRODUCTION

Oxfam GB's Global Performance Framework is part of the organisation's effort to better understand and communicate its effectiveness, as well as enhance learning across the organisation. Under this Framework, a small number of completed or mature projects are selected at random each year for an evaluation of their impact, known as an 'Effectiveness Review'. One key focus is on the extent to which they have promoted change in relation to relevant Oxfam GB global outcome indicators.

The effectiveness review that took place in Chirumanzu, Zvishavane and Gutu districts in November and December 2013 was aimed at evaluating the success of the Food Security and Livelihoods Programme in promoting food security and strengthened livelihood options among the project participants. The focus of the review was on the 15 wards across the three districts supported by the project from 2010 through to its completion in March 2014. The project activities were implemented by Oxfam in conjunction with two local partner organisations – Batanai HIV & AIDS Service Organisation (BHASO) and Midlands Aids Caring Organisation (MACO).

This report presents the findings of the Effectiveness Review. Section 2 briefly reviews the activities and the intervention logic of the project. Sections 3 and 4 describe the evaluation design adopted and how this design was implemented. Section 5 presents the results of the data analysis, based on the comparison of outcome measures between the intervention and comparison groups. Section 6 concludes with a summary of the findings and some considerations for future learning.

2 PROJECT DESCRIPTION

The overall objective of the project under review was to contribute to the eradication of extreme poverty and hunger among the poor and vulnerable in Midlands and Masvingo provinces of Zimbabwe. The project aimed to do this by enhancing livelihood options for households from selected communities in 15 wards across three districts in these provinces.

The project aimed to directly benefit up to 24,500 people across the three target districts through three key interventions:

- Summer agricultural inputs together with conservation agriculture training.
- Small livestock support, including livestock vouchers, training and veterinary kits.
- Development of communal market garden linkages.

A summary of the numbers of project participant beneficiaries by district and intervention group is shown in Table 2.1.

Table 2.1: Key project interventions

District	Wards	Inputs/ conservation agriculture	Small livestock support	Communal market-garden linkages
Gutu	4	5,300	800	400
Zvishavane	5	6,700	1,000	500
Chirumanzu	6	8,000	1,200	600

Figure 2.1: Map of Zimbabwe, with the project districts marked in green[1]

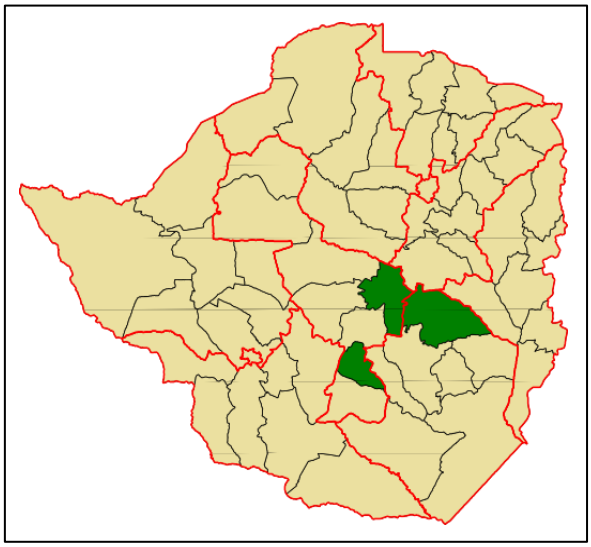
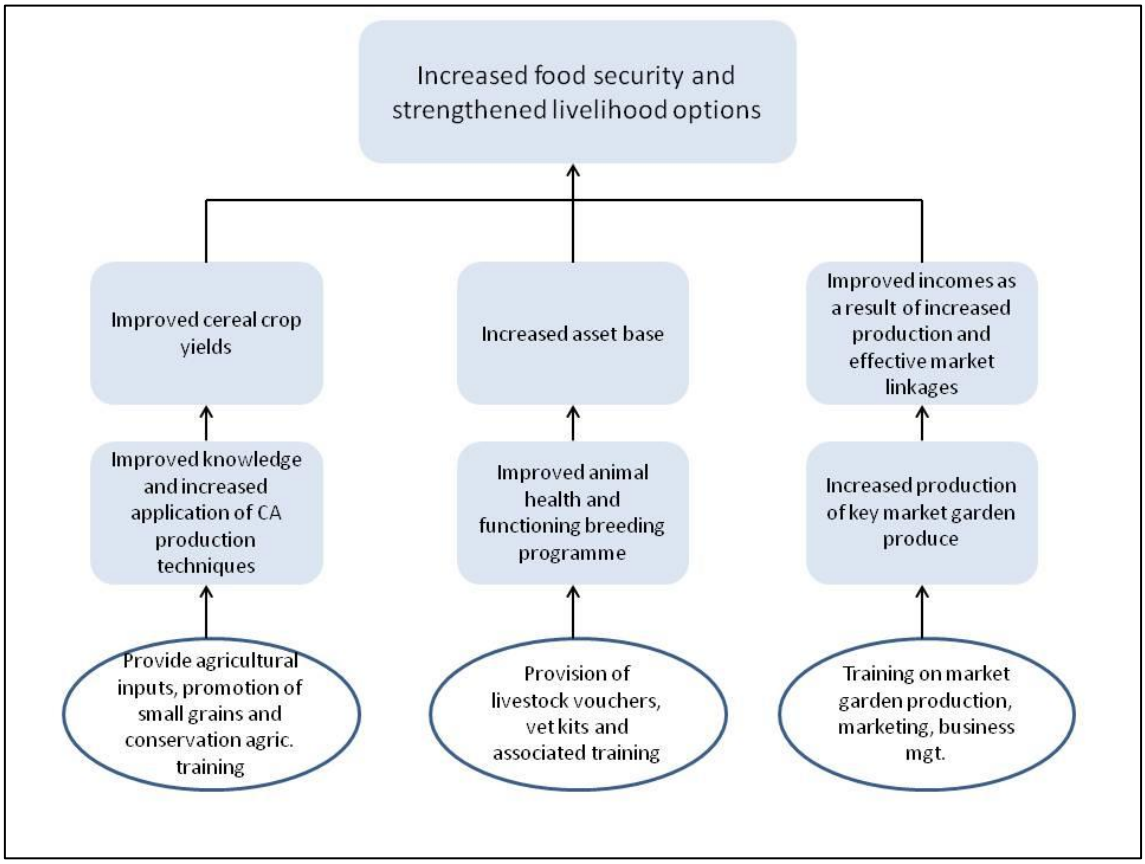


Figure 2.2 presents a simplified logic model to present how the various interventions are intended to affect food and livelihood security.

As mentioned, the first intervention related to the provision of agricultural inputs and training on conservation agriculture techniques. The promotion of these techniques, such as minimal tilling, crop rotation and use of mulching, were intended to mitigate the impact of successive droughts and ensure the efficient use of soil and limited water.

The techniques also emphasised the use of locally available resources, such as animal manure. Previous experience of conservation agriculture in the area has demonstrated higher crop yields than slash and burn or extensive tilling approaches. For training purposes, farmers were organised into groups whereby intensive training workshops on conservation agriculture techniques were delivered to representatives from the groups. In addition, demonstration plots were set up in each group. Further support was provided by agricultural extension workers, and exchange trips between the groups were organised. In addition, agricultural inputs – including open-pollinated drought-tolerant sorghum seed and top dressing fertiliser – were provided to the farmers. These interventions are intended to result in an increased and more secure cereal harvest for the supported farmers.

Figure 2.2: Project Theory of Change (simplified)



A previous Oxfam study (conducted in June 2009) indicated that many of the more vulnerable households in the project areas had sold their livestock in exchange for food and other services. Therefore the second intervention – the provision of livestock – aimed to support the rebuilding of livelihood assets through the distribution of fast-breeding small ruminants, such as goats and chickens. Livestock fairs were held in each ward, and each selected household was given a voucher that could be exchanged for an animal. Veterinary specialists were on hand to check the health of the animals prior to purchase, and recipients were trained in basic animal husbandry practices, including breeding, nutrition, disease control and housing. Those receiving livestock were also trained on how to integrate the livestock system into the agricultural system, such as the use of animal manure to improve soil fertility. Through the course of the project, further support was provided, including the supply of veterinary kits, drugs and information, education and communication materials.

The third intervention worked with 50 communal garden groups whose aim was to produce high-value crops for specific markets. These groups consisted of 30 households on average, each growing on approximately a tenth of an acre. Farmers in

the group received start-up kits, and training on agronomy and marketing. The project adopted a market-led production model that had the garden groups organised around Collection and Information Centres (CICs). This is a participatory approach where a CIC management committee is formed for every five communal garden groups, with responsibility for (a) identifying and linking smallholder farmers to output/input markets during and after the project, (b) aggregating the fragmented produce in order to meet high-value market quantity and quality demands, (c) providing other market-related information, and (d) coordinating capacity activities to support production and market linkages. By the end of the project the aim was that each CIC would be promoting production and marketing of at least three types of high-value crops, each with secured buyers (such as agro-processors, exporters, or supermarkets). Each CIC was assisted to establish a fund to support input and output market-related activities at the initial stages. Additionally, training on nutrition and food preservation was provided directly to the farmers. The overall aim of this intervention was to strengthen the capability and capacity of local communal garden farmers to compete effectively in order to boost and sustain their incomes from profitable market goods.

3 EVALUATION DESIGN

The central problem in evaluating the impact of any project is how to compare the outcomes that result from that project with *what would have been the case* without that project having been carried out. In the case of this Effectiveness Review, information about the situation of the households who were supported by the project was collected through a household questionnaire – but clearly it was not possible to know what their situation would have been had they not had the opportunity to participate in this project. In any evaluation, that 'counterfactual' situation cannot be directly observed: it can only be estimated.

In the evaluation of programmes that involve a large number of units (whether individuals, households, or communities), common practice is to make a comparison between units that were subject to the programme and those that were not. As long as the two groups can be assumed to be similar in all respects except for the implementation of the specific project, observing the situation of those where the project was not implemented can provide a good estimate of the counterfactual.

An ideal approach to an evaluation such as this is to select the sites in which the programme will be implemented at random. Random selection minimises the probability of there being systematic differences between the project participants and non-participants, and so maximises the confidence that any differences in outcomes are due to the effects of the project.

In the case of the project examined in this Effectiveness Review, the implementation sites were not selected at random. Instead, communities were specifically chosen to be included in the project, based on their being particularly vulnerable or particularly in need of support in building livelihood sustainability. However, discussions with the implementation staff highlighted that there were other communities in the implementation area with a similar level of vulnerability that could have been suitable for inclusion in the project, if resources had allowed. This allowed a 'quasi-experimental' evaluation design to be adopted, in which the situation of households in nearby non-project communities was assumed to provide a reasonable counterfactual for the situation of households that participated in the project.

To improve the confidence in making this comparison, households in the project communities were 'matched' with households with similar characteristics in the non-project (or 'comparison') communities. Matching was performed on the basis of a variety of characteristics – including household size, ethnicity, education level, productive activities, and indicators of material well-being, such as housing conditions and ownership of assets. Since some of these characteristics may have been affected by the project itself (particularly those relating to productive activities and wealth indicators), matching should be performed on the basis of these indicators *before* the implementation of the project. Since baseline data were not available, survey respondents were asked to recall some basic information about their household's situation from 2009, before the project was implemented. Although this recall data is unlikely to be completely accurate, it should not lead to significant bias in the estimates as long as measurement errors due to the recall data are not significantly different for respondents in the intervention and comparison groups.

The survey data provided a large number of household characteristics on which matching could be carried out. One practical problem is that it would be very difficult to find households in the comparison communities that correspond exactly in all these characteristics to households in the project communities. Instead, these characteristics were used to calculate a 'propensity score', the conditional probability of the household

being in an intervention village, given particular background variables or observable characteristics. Households in the project and comparison communities were then matched based on their having propensity scores within certain ranges. Tests were carried out after matching to assess whether the distributions of each characteristic were similar between the two groups. Technical details on this approach are described in Appendix 2.

As a check on the results derived from the propensity-score matching process, results were also estimated using multivariate regression models. Like propensity-score matching, multivariate regression also controls for measured differences between intervention and comparison groups, but it does so by isolating the variation in the outcome variable explained by being in the intervention group after the effects of other explanatory variables have been accounted for.

It should be noted that both propensity-score matching and multivariate regression rely on the assumption that the 'observed' characteristics (those that are collected in the survey and controlled for in the analysis) capture all of the relevant differences between the two groups. If there are 'unobserved' differences between the groups, then estimates of outcomes derived from them may be misleading. Unobserved differences between the groups could potentially include differences in attitudes or motivation (particularly important when individuals have taken the initiative to participate in a project), differences in community leadership, or local-level differences in weather or other contextual conditions faced by households. The choice of which intervention and comparison villages to survey for this Effectiveness Review was made principally to minimise the potential for any such unobservable differences to bias the results.

4 DATA

4.1 SAMPLING APPROACH

The selection of project communities to be included in the Effectiveness Review was made by simple random selection from the complete list of communities in which the project had been implemented. The selection of comparison communities was carried out through discussion with partner organisation staff who know the three implementation districts well. Communities were selected that were thought to have similar characteristics to the project communities in terms of their approximate size, livelihoods activities, and distance to major roads. Due to the way in which ward boundaries had been defined in each of the districts, some comparison communities could be identified from within the same ward as the project communities, and some had to be found in neighbouring wards.

Communities were informed in advance of the survey team's arrival, through local contacts. Respondents in the project communities were selected randomly using complete village household lists, and were mobilised appropriately. In the comparison communities, the survey team first met with the village leader and worked to produce a basic map of how households were distributed across the community. Using this, in conjunction with the sample size allocated to that community, the survey team spread out to ensure that all areas of the community were covered.

Table 4.1 below shows the numbers of households interviewed in each ward and district in the survey. A total of 1,030 households were interviewed, of which 494 were in project communities and the remaining 536 in comparison communities.

Table 4.1: Project participants and comparison households interviewed, by district and ward

District	Project sites		Comparison sites	
	Ward	Households interviewed	Ward	Households interviewed
Gutu	12	75	12	56
	13	115	13	62
			39	73
Chirumanzu	4	40	23	177
	8	61		
	10	42		
Zvishivane	4	58	10	82
	8	52	13	86
	9	51		
Total		**494**		**536**

Findings were analysed separately for each of the three intervention groups. The number of households interviewed from each of the three groups were as follows:

- Conservation agriculture and inputs only: 127 households
- Small livestock support: 191 households
- Communal market-garden linkages: 176 households

It should be noted in addition that project participants who received small livestock support or communal garden support *also* received conservation agriculture/input support. Therefore the analysis of outcomes among the second and third intervention groups includes the impact of the conservation agriculture and inputs support *in addition to* the impact of the small livestock or communal market-garden support.

In principle the overall impact of the project should be calculated by weighting the results among the three intervention groups to account for the fact that those supported by the small livestock support and communal market-garden linkages interventions are over-represented in the sample of project participants. However, for simplicity, the overall figures presented in Section 5 of this report are simple averages across all the project participants interviewed.[2]

4.2 ANALYSIS

The first stage of the analysis was to compare households interviewed in the intervention and comparison communities in terms of their demographic characteristics, livelihoods activities and economic situation in 2009. These data were based on information recalled during the questionnaire or reconstructed from the household composition at the time of the survey. The full comparison is shown in Appendix 1.

Some important differences were found between the project participants and comparison households. For example, the project participant households were generally larger, with higher levels of education, and tended to be wealthier in 2009 (according to the data on asset ownership and housing conditions recalled from that time) than the comparison households. The project participant households were also more likely than comparison households to report that they were engaged in farming (and were farming a larger area of land on average), market gardening and rearing livestock in 2009.

These differences, which apparently existed before the project, have the potential to bias any comparison of the project's outcomes between the project participants and comparison households. It was therefore important to control for these baseline differences when making such comparisons. As described in Section 3, the main approach used in this Effectiveness Review to control for the baseline differences was propensity-score matching (PSM). The full details of the matching procedure applied are described in Appendix 2. After matching, the project and comparison households were reasonably well-balanced in terms of the recalled baseline data.

All the results described in Section 5 of the report were tested for robustness by estimating them with several alternative statistical models, including alternative PSM models and linear or probit regression models.

5 RESULTS

Statistics Introduction

This report is intended to be free from excessive technical jargon, with more detailed technical information being restricted to the footnotes. However, there are some statistical concepts that cannot be avoided in discussing the results.

Effect size

The size or magnitude of an effect when evaluating outcomes refers to the size of the difference between groups. In this report, results will usually be stated as the average difference between households living in communities where the project was implemented (that is, the 'intervention group') and the matched households in communities where the project was not implemented (the 'comparison group').

Statistical significance

When we refer to 'impact' in this report, we mean differences between the households in the project and comparison communities that are 'statistically significant'. For example, imagine that we observe that the average household interviewed in the project communities owns one more head of livestock than the average household sampled in the comparison communities. This seems to be a large difference between the project and comparison communities, given that the average household owns only three head of livestock. However, it is important to remember that this estimated average impact is derived from data on a *sample* of households in the project and comparison communities, rather than data on the whole population. It is possible that, by chance, we happen to have drawn beneficiaries who own relatively large numbers of livestock, but that the ownership in the overall population pool is very similar to that in the comparison communities.

For this reason, it is necessary to take into consideration the statistical probability of measuring an impact of one additional head of livestock if there were in reality no difference in livestock ownership between the intervention and comparison groups. This probability is usually referred to as the *p*-value. *p*-values help to evaluate study hypotheses. The default hypothesis is always that there are no differences between the intervention and comparison groups. When a difference is detected, the *p*-value is used to evaluate whether the default hypothesis (that there is no difference between the intervention and comparison groups) should be rejected – that is, to conclude that the project had an impact. If the *p*-value is small, for instance 1 per cent, this means that the probability that our sample would show intervention households owning on average an additional head of livestock compared to comparison households if the true difference was zero is only 1 per cent. This is a very small probability, and so we would have confidence in rejecting the default hypothesis that the project had no impact on this outcome. We would then say that the result is 'statistically significant'. Note that the smaller the sample size and the greater the variation in the outcome measures among the sampled households, the larger the *p*-value will be, and hence the less likely we are to conclude that a result is statistically significant.

In the tables of results on the following pages, statistical significance will be indicated with asterisks, with one asterisk (*) indicating a *p*-value of less than 1 per cent, two asterisks (**) indicating a *p*-value of less than 5 per cent and three asterisks (***) indicating a *p*-value of less than 10 per cent. The higher the *p*-value, the less confident we are that the measured estimate reflects the true impact. Results with a *p*-value of more than 10 per cent are not considered to be statistically significant.

5.1 INTRODUCTION

This section presents a comparison of the self-help group (SHG) members and comparison respondents in terms of various outcome measures relating to the project under review. In the tables of results, asterisks are used to indicate where the differences are statistically significant at least at the 10 per cent significance level.

The results are shown after correcting for apparent baseline differences between the households supported by the project (the 'intervention group') and the comparison households (the 'comparison group') using a propensity-score matching (PSM) procedure. The details of this procedure are discussed in Appendix 2. All outcomes have also been tested for robustness to alternative statistical models.

It is important to recall, as highlighted in Section 3, that PSM and regression models can control only for the baseline differences between the project households and comparison households for which data was collected in the survey. If there are any 'unobserved' pre-existing differences between the two groups – such as individuals' attitudes, motivation, skills or confidence – then these may bias the estimates of outcomes described in Section 5.

5.2 INVOLVEMENT IN PROJECT ACTIVITIES AND SUPPORT RECEIVED

The first step in understanding what impact this project has had is to examine the extent to which respondents participated in the activities implemented under the project. This is an important consideration, firstly as it represents the analysis of the first step of the project's theory of change – i.e. are project participants being exposed to the intended livelihood-support interventions? Secondly, it is important to assess whether respondents in comparison areas also report receiving such support in their communities, as this may have an effect on the differences that may be detected between the intervention and comparison groups in the outcome measures reported subsequently.

Table 5.1 shows the proportions of households in the project and comparison communities that reported receiving various project-related inputs since 2009. The first column shows that almost all of those supported by the project received agricultural inputs at some point since that time. Of note is that 70 per cent of comparison households also reported having received inputs, presumably from other organisations with projects in the area. This issue is not repeated for the remaining two project interventions, where fewer than five per cent of the comparison households reported receiving support livestock-related or market-garden-related support.

Also important to note from Table 5.1 is that large numbers of the project participants reported receiving forms of support that were *not* thought to have been provided to them. For example, nearly 60 per cent of households in the market-garden intervention group reported receiving livestock support. This may partly reflect confusion on the part of respondents about specifically what they received. But it is also important to bear in mind that the results in this report may represent, to some extent, the effects of a 'basket' of all three interventions.

Table 5.1: Proportions of households having received support since 2009

	1	2	3
	Provision of agricultural inputs %	Livestock support %	Provision of gardening and marketing tools %
Overall			
Intervention group mean:	93.5	60.3	59.0
Comparison group mean:	69.6	4.5	2.6
Difference:	23.8*** (2.7)	55.8*** (2.6)	56.3*** (2.3)
Observations (intervention group):	490	489	490
Observations (total):	1013	1012	1013
Basic intervention group			
Intervention group mean:	95.2	30.4	29.6
Comparison group mean:	66.9	4.6	3.0
Difference:	28.3*** (3.2)	25.8*** (4.5)	26.6*** (4.3)
Observations (intervention group):	127	127	127
Observations (total):	652	652	652
Livestock group			
Intervention group mean:	93.6	82.4	51.3
Comparison group mean:	68.2	3.8	2.4
Difference:	25.4*** (3.2)	78.5*** (3.0)	49.0*** (3.8)
Observations (intervention group):	188	188	188
Observations (total):	682	682	682
Market garden group			
Intervention group mean:	91.8	58.8	88.3
Comparison group mean:	73.8	4.0	3.1
Difference:	18.0*** (3.7)	54.8*** (4.1)	85.2*** (2.9)
Observations (intervention group):	171	170	171
Observations (total):	600	599	600

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates bootstrapped with 1000 repetitions.

Table 5.2 moves on from the types of tangible support received by households to the types of training received. In each of the types of training examined, it is clear that intervention households reported greater exposure than comparison households. While we found in Table 5.1 that a large majority of all households – including comparison households – received agricultural inputs, Column 1 of Table 5.2 indicates that only just over a third of comparison households received training on conservation agriculture.

It should also be noted that over 90 per cent of the project participant households rated each of the trainings as ‘very useful’, and over 90 per cent claimed to have applied techniques learnt from the sessions.

Table 5.2: Proportions of households having received training since 2009

	1	2	3	4	5	6	7	8
	Training on conservation agriculture %	Training on animal health and husbandry %	Training on marketing %	Training on improved agronomic practices in gardens %	Training on agricultural production %	Training on preservation and nutrition %	Training on health issues %	Training on reducing gender-based violence %
Overall								
Intervention group mean:	92.9	67.6	51.4	58.4	62.7	52.2	86.3	70.0
Comparison group mean:	35.7	24.5	9.3	25.5	38.6	23.3	75.7	55.5
Difference:	57.1*** (2.9)	43.1*** (3.2)	42.2*** (2.7)	32.9*** (3.3)	24.0*** (3.5)	28.9*** (3.3)	10.7*** (2.7)	14.5*** (3.4)
Observations (intervention group):	490	490	490	490	490	490	490	490
Observations (total):	1013	1013	1013	1013	1013	1013	1013	1013
Basic intervention group								
Intervention group mean:	96.8	49.6	37.6	39.2	68.0	52.8	87.2	70.4
Comparison group mean:	33.6	22.4	6.2	21.7	38.6	22.3	77.1	56.5
Difference:	63.2*** (3.2)	27.2*** (5.1)	31.4*** (4.5)	17.5*** (5.0)	29.4*** (5.1)	30.5*** (5.1)	10.1*** (3.9)	13.9*** (4.9)
Observations (intervention group):	127	127	127	127	127	127	127	127
Observations (total):	652	652	652	652	652	652	652	652
Livestock group								
Intervention group mean:	92.5	79.7	40.1	50.3	59.9	53.5	89.3	72.7
Comparison group mean:	39.1	26.8	11.0	26.1	38.9	25.4	74.8	55.9
Difference:	53.4*** (3.4)	52.8*** (3.9)	29.2*** (4.1)	24.2*** (4.4)	21.0*** (4.6)	28.0*** (4.5)	14.5*** (3.2)	16.8*** (4.3)
Observations (intervention group):	188	188	188	188	188	188	188	188
Observations (total):	682	682	682	682	682	682	682	682
Market garden group								
Intervention group mean:	90.6	67.8	73.7	80.7	61.4	49.1	81.9	66.7
Comparison group mean:	35.3	24.5	10.6	27.3	36.1	20.1	74.4	55.5
Difference:	55.4*** (4.0)	43.3*** (4.6)	63.1*** (3.9)	53.4*** (4.3)	25.3*** (5.0)	29.0*** (4.7)	7.5* (4.4)	11.2** (5.1)
Observations (intervention group):	171	171	171	171	171	171	171	171
Observations (total):	600	600	600	600	600	600	600	600

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates bootstrapped with 1000 repetitions.

As discussed in Section 2, the project participants were formed into groups for the purposes of carrying out the training and other project activities. Figure 5.1 compares the project participants with the comparison households in terms of their reported participation in various types of groups. As expected, participation in farmer groups, communal garden groups and agricultural cooperatives was much more common among the participants than among comparison households. However, there are also significant differences in people's participation in types of group not directly related to the project activities: natural-resource management committees, savings groups and (less clearly) water committees and women's groups. In some of these group types, intervention households were not only more likely than comparison households to participate, but also (among those who were participating) more likely to say that they are involved in decision-making within the groups.

It would be interesting to follow up on how the project may have had an influence in the establishment of or participation in these types of group. On the other hand, it must be recalled that the project participants were self-selected, and that their participation in these types of community group may have been higher than among the comparison households even before the project began.

The data shown in the first column of Table 5.3 confirm the pattern seen in Figure 5.1: project households were participating, on average, in one or two more types of community group than were comparison households. The second column of the table shows the proportion of households meeting a simple threshold, of participating in at least two types of community group, and reporting that they are involved to at least a medium extent in decision-making in at least one of those groups. More than two thirds of the project participant households met that criterion, against only half of the comparison households.

Figure 5.1: Proportion of households who attend meetings of various community groups

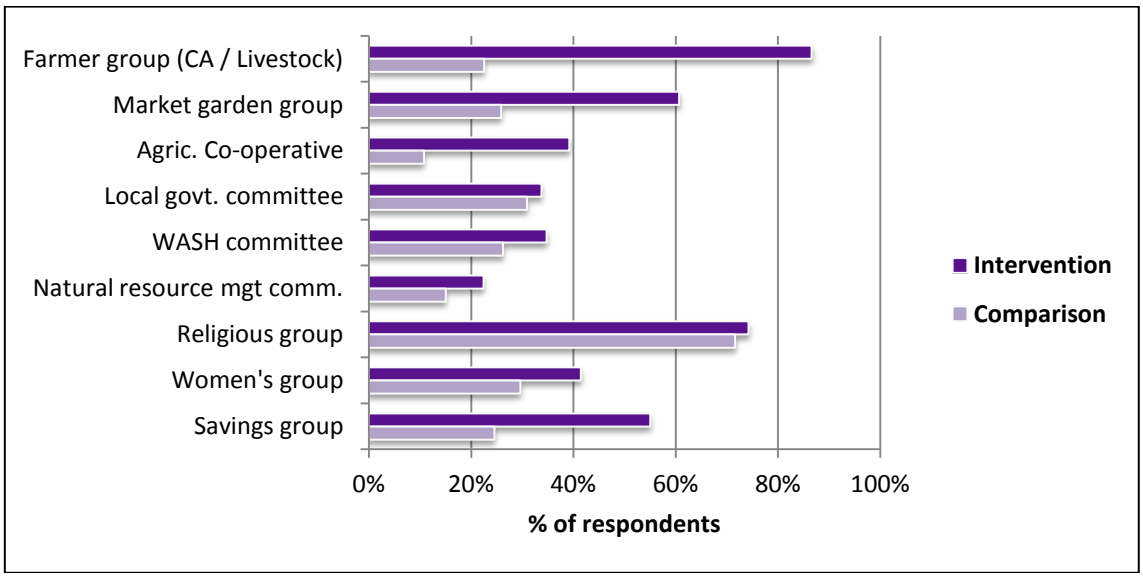


Table 5.3: Group participation

	1	2
	Number of community groups of which household members attend meetings	Household members attend meetings of at least two community groups, and have a decision-making role in at least one %
Overall		
Intervention group mean:	4.5	69.4
Comparison group mean:	2.9	49.0
Difference:	1.6*** (0.1)	20.4*** (3.4)
Observations (intervention group):	490	490
Observations (total):	1013	1013
Basic intervention group		
Intervention group mean:	4.2	67.2
Comparison group mean:	2.7	41.8
Difference:	1.5*** (0.2)	25.4*** (5.1)
Observations (intervention group):	127	127
Observations (total):	652	652
Livestock group		
Intervention group mean:	4.3	71.7
Comparison group mean:	3.1	52.9
Difference:	1.2*** (0.2)	18.7*** (4.2)
Observations (intervention group):	188	188
Observations (total):	682	682
Market garden group		
Intervention group mean:	4.9	68.4
Comparison group mean:	2.9	51.0
Difference:	2.0*** (0.2)	17.5*** (5.17)
Observations (intervention group):	171	171
Observations (total):	600	600

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates bootstrapped with 1000 repetitions.

5.3 AGRICULTURAL PRODUCTION AND SALES

We now turn to consider the effect of the various project activities on households' agricultural activities. Table 5.4 compares the project participants and comparison households in terms of some key indicators of their investment in agriculture during the 12 months prior to the survey. Firstly, it can be seen in column 1 that there is some evidence that the project participants were farming more land than the comparison households. Based on respondents' recollections of how much land they were farming in 2009, it appears that both groups – project participants and comparison households – were farming less land on average in 2013 than they had been in 2009, but the decrease was smaller among the project participants.[3]

One of the key activities carried out across all three of the project interventions was training in improved agricultural or livestock management. A key assumption of the project's theory of change is that such training would lead to changed *practice* of these different techniques. As part of the questionnaire, respondents were asked whether they had practised a range of improved agricultural methods – including use of irrigation, soil testing, organic fertiliser, compost or green manure, minimum tillage, timely planting, crop rotation, digging trenches, leaving debris in the plot, and growing vegetables – during the 12 months prior to the survey.

Figure 5.1 shows a comparison of the project participants and comparison households in terms of adoption of each of these techniques. There are large differences between the project and comparison households in some of the key activities related to conservation agriculture, such as minimum tillage, crop rotation, using organic fertilisers and soil fertility trenches. This suggests that the project has been successful in encouraging the practice of conservation agriculture among participants.

The vast majority of households interviewed (85 per cent) said that they were growing vegetables in the year prior to the survey. As would be expected, there was almost universal (98 per cent) adoption among the households supported by the project in market gardening.

Figure 5.1: Proportion of households reporting practice of various improved activities during the year prior to the survey

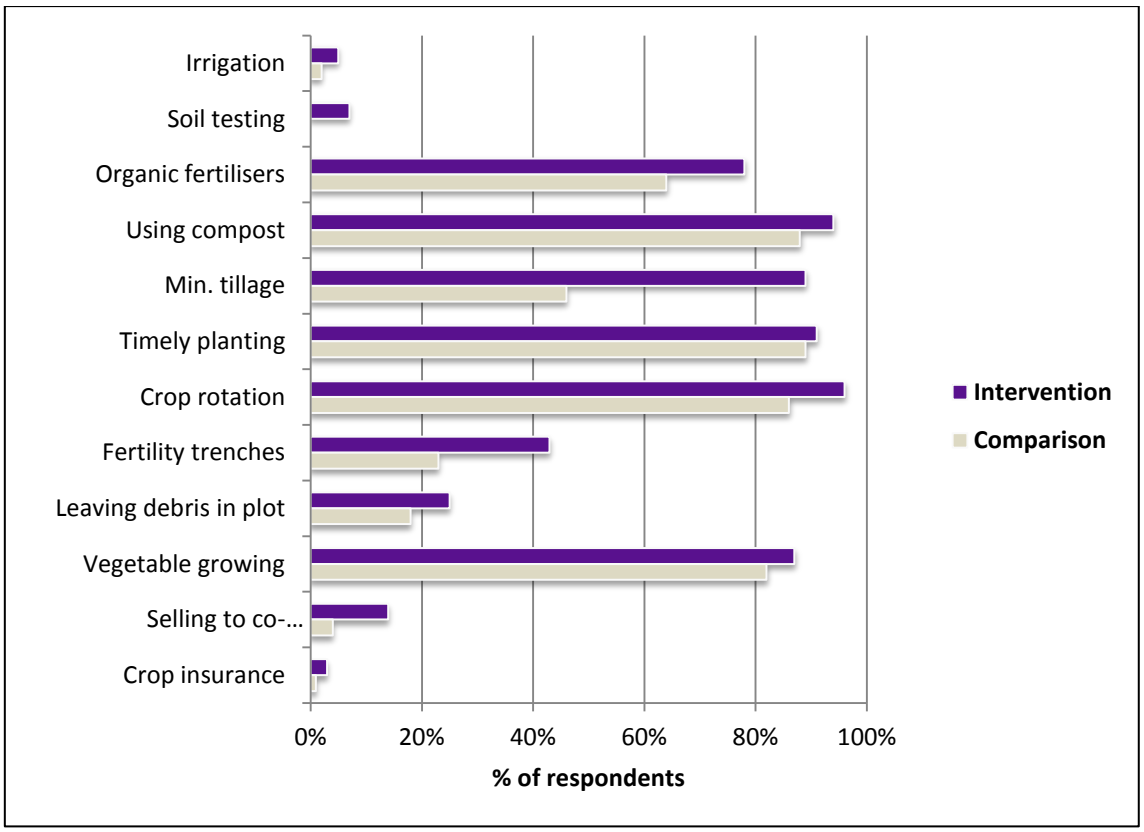


Table 5.4: Engagement in agricultural activities

	1	2	3
	Land area farmed by household during past year (hectares)	Number of improved agricultural activities practised by household	Number of crop types grown by household during past year
Overall			
Intervention group mean:	1.9	6.2	7.7
Comparison group mean:	1.8	5.0	5.9
Difference:	0.2* (0.1)	1.2*** (0.1)	1.8*** (0.1)
Observations (intervention	490	490	490
Observations (total):	1013	1013	1013
Basic intervention group			
Intervention group mean:	1.9	5.95	7.1
Comparison group mean:	1.7	4.7	5.5
Difference:	0.2 (0.1)	1.2*** (0.2)	1.6*** (0.3)
Observations (intervention	127	127	127
Observations (total):	652	652	652
Livestock group			
Intervention group mean:	1.9	6.1	7.5
Comparison group mean:	1.7	5.1	6.1
Difference:	0.2** (0.1)	1.0*** (0.1)	1.4*** (0.2)
Observations (intervention	188	188	188
Observations (total):	683	683	683
Market garden group			
Intervention group mean:	1.85	6.3	8.3
Comparison group mean:	1.6	5.1	6.0
Difference:	0.2 (0.2)	1.2*** (0.1)	2.3*** (0.2)
Observations (intervention	172	172	172
Observations (total):	602	602	602

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates bootstrapped with 1000 repetitions.

Column 2 of Table 5.4 confirms the pattern shown in Figure 5.1 by considering the average number of improved practices (from the 10 listed above) applied by households during the year prior to the survey. Project participant households used six of these practices on average, against only five of the practices among the comparison households.

Alongside encouraging project participants to implement improved agricultural or livestock activities, the project also sought to encourage farmers to grow drought-tolerant crops, such as sorghum, and expand into high-value vegetable production. One indication of whether farmers have expanded their crop portfolio is to analyse the differences between the intervention and comparison households in the number of crops being cultivated in the year prior to the survey.

Column 3 of Table 5.4 shows the average number of crop types cultivated by the sample households. The figures provide clear evidence that project participants have increased the range of crops they are cultivating, to an average of 7.7 crop types,

compared to 5.9 crop types among the comparison households. As would be expected, households supported in market gardening were cultivating a particularly large range of crop types.

Figure 5.2 expands this analysis by showing the proportion of intervention and comparison households cultivating different types of crops. Here it becomes more apparent where the key changes in crop cultivation have occurred. There is evidence that the project has been successful in one of its key aims of encouraging participants to grow sorghum: nearly twice as many intervention households (73 per cent) harvested some sorghum in the year prior to the survey as comparison households (38 per cent). There are also large and statistically significant differences in the proportion of households growing several types of vegetables, including cowpeas, cabbages, tomatoes, onions and green peppers, providing evidence that the project has had a significant effect on the cultivation of these crops.

Table 5.5 shows figures for the *quantity* of crops harvested during the year prior to the survey. It is apparent that there are significant differences between the intervention and comparison households for each of the crop types with some of the differences being very large. For example, in column 1 it can be seen that the project participant households reported harvesting nearly 80 kg more maize than did comparison households, with the difference particularly large among those supported in market gardening.

Figure 5.2: Proportion of households harvesting various crops during the year prior to the survey

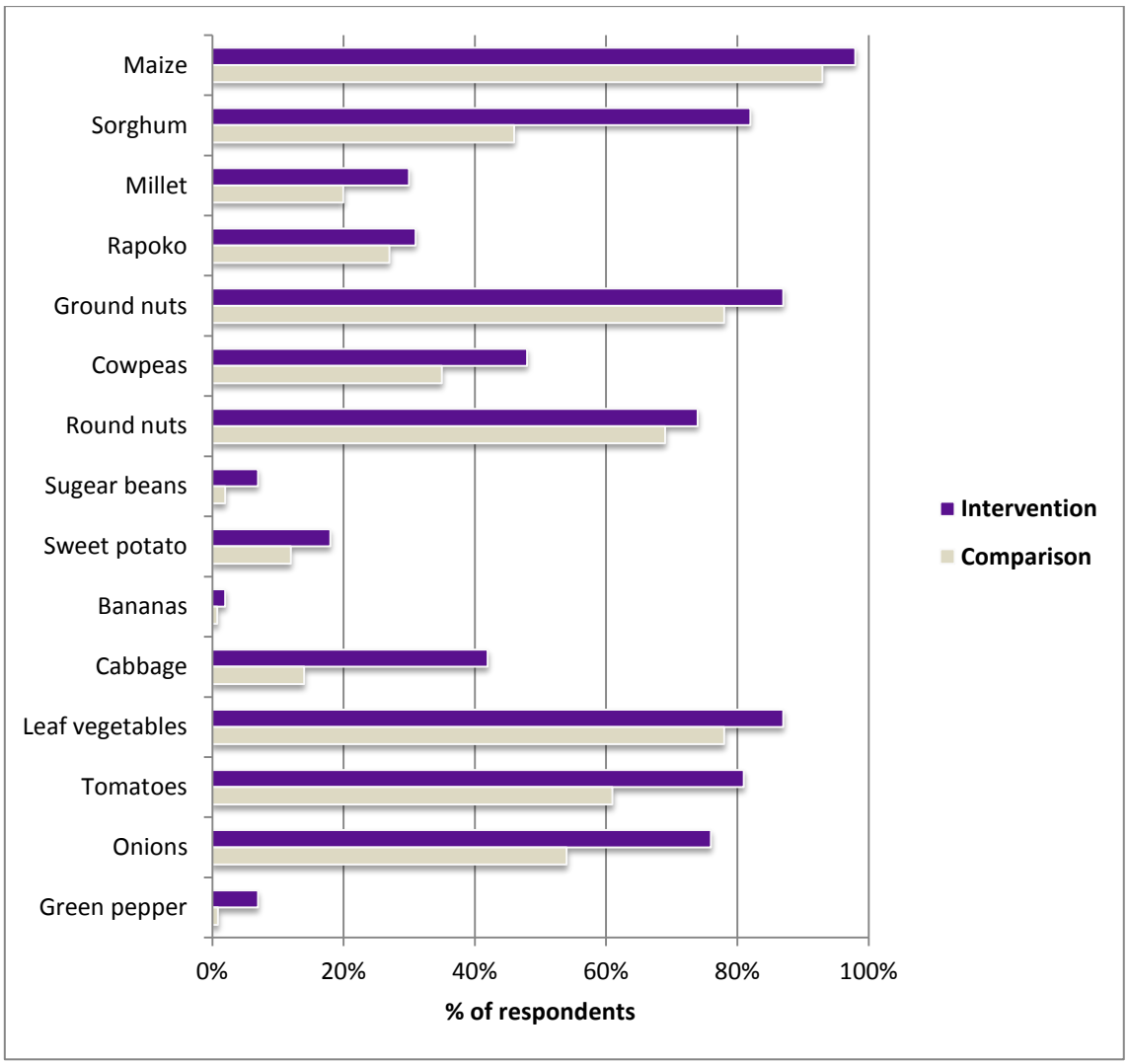


Table 5.5: Crop production per household during the 12 months prior to the survey

	1	2	3	4	5	6	7	8	9	10
	Maize (kg)	Sorghum (kg)	Millet (kg)	Rapoko (kg)	Ground nuts (kg)	Round nuts (kg)	Cowpeas (kg)	Tomatoes (kg)	Onions (kg)	Cabbages (kg)
Overall										
Intervention group mean:	258	159	50.9	21.7	47.5	24.8	10.5	48.2	19.4	17.1
Comparison group mean:	177	23	21.5	8.24	32.5	17.4	4.33	18.3	7.02	7.3
Difference:	81*** (31)	136*** (12)	29.4*** (6.6)	13.5*** (2.84)	15.1* (7.8)	7.4*** (2.6)	6.15*** (1.4)	29.9*** (3.6)	12.4*** (1.5)	9.8*** (2.6)
Observations (intervention group):	490	489	490	490	489	483	487	489	487	488
Observations (total):	1009	1006	1007	1004	1002	998	999	1005	997	1006
Basic intervention group										
Intervention group mean:	227	235	48.3	26.3	47.8	26.7	10.3	29.3	13.0	12.1
Comparison group mean:	181	26	22.1	7.5	30.3	17.0	4.8	15.1	5.8	5.5
Difference:	46 (42)	208*** (23)	26.2*** (9.8)	18.8*** (5.86)	17.4 (11.0)	9.7** (4.3)	5.6*** (2.1)	14.2*** (5.4)	7.2*** (2.2)	6.6** (3.3)
Observations (intervention group):	127	127	127	127	127	126	127	127	127	127
Observations (total):	648	646	646	643	642	643	641	645	639	647
Livestock group										
Intervention group mean:	249	135	49.0	21.7	43.8	21.9	12.3	41.7	15.5	10.7
Comparison group mean:	195	24	24.2	9.3	35.0	18.4	5.3	19.1	7.8	6.25
Difference:	54 (37)	111*** (22)	24.7*** (8.9)	12.4*** (4.8)	8.7 (8.1)	3.5 (3.2)	7.0*** (2.6)	22.6*** (5.0)	7.8*** (1.7)	4.4** (2.2)
Observations (intervention group):	188	187	188	188	188	184	185	187	186	186
Observations (total):	679	676	677	674	673	671	669	675	668	676
Market garden group										
Intervention group mean:	291	132	55.9	18.7	50.7	25.7	8.5	67.1	26.4	27.2
Comparison group mean:	173.5	19	16.6	6.8	34.8	17.1	3.6	19.4	7.5	7.75
Difference:	118* (63)	113*** (12)	39.3*** (10.9)	11.8*** (3.8)	15.9 (15.9)	8.5** (3.9)	4.9*** (1.5)	47.7*** (6.4)	18.9*** (2.9)	19.4*** (4.1)
Observations (intervention group):	172	172	172	172	171	170	172	172	171	172
Observations (total):	602	601	601	598	597	597	598	600	594	602

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates bootstrapped with 1000 repetitions.

The production of sorghum was particularly high in the basic intervention (conservation agriculture) group, who produced 235 kg on average during the year prior to the survey. As noted above, relatively few of the comparison households produced any sorghum; of those who did, the quantity produced was much smaller than the project participants.

The first column of Table 5.6 combines the information from production of all crops recorded in the survey, to provide an approximate indication of the project's impact on overall crop production. Of course, combining all crops by weight is an approximate measure (and it omits cabbages and leaf vegetables, for which production was not recorded by weight in the questionnaire), but the pattern in the results is nevertheless clear: total crop production among the project participants was approximately double that among the comparison households.

It will be recalled from Table 5.4 that project participants reported cultivating on slightly more land during the year prior to the survey than did comparison households. The fact that project participants apparently produced approximately double the quantity of crops indicates, therefore, that crop *yields* must have increased considerably. In this light, it is interesting that, when asked for a subjective assessment of whether their crop yields had increased since 2009, only 38 per cent of project participants responded positively – a proportion that (as shown in column 2 of Table 5.6) does not differ significantly from the comparison respondents. The only exception to this is among the market-garden project participants, where a larger proportion (51 per cent) reported having experienced an increase in yields. On the other hand, 10 per cent of the project participants said that they had experienced a *large* increase in yields, against only four per cent of the comparison respondents.

The remaining columns of Table 5.6 consider sales of crops during the year prior to the survey. It can be seen from column 3 that not only did the project participants harvest more crops than did comparison households, but a much larger proportion of them brought some crops to market. Even among those households that made some crop sales, the volume of crops sold was larger among the project households than comparison households, so that there is a very large difference in terms of the quantity of crops sold (shown in weight terms in column 4 of the table) and the revenue generated (shown in column 5). Households of project participants reported generating US$109 from crop sales on average during the year prior to the survey, against an average of just US$37 among the comparison households.

Respondents were also asked about the channels through which they had sold most of their crops. Most sales, among both project participants and comparison households, were reported to have been made in local markets. Notably, only seven per cent of the project participants reported having made sales to a cooperative – though this figure was slightly higher (at 10 per cent) among participants in the market-garden intervention.

In column 6 of Table 5.6, it can be seen that 37 per cent of project participants reported that their income from crop sales had increased since 2009, whereas only 26 per cent of comparison households did so. However, this result is essentially confined to the market-garden group; there is no such difference among the basic intervention group, and that among the livestock intervention group is not statistically significant. This subjective assessment on the part of respondents is difficult to reconcile with the much more positive results derived from the detailed sales data. On the other hand, a much larger proportion of the project participants (13 per cent) said that they had experienced a 'large' increase in income from crop sales since 2009 than did comparison households (two per cent), and this result applies across all three of the intervention groups. In any case, the detailed sales data are thought to provide a more reliable assessment of the project's impact than do these subjective measures.

Table 5.6: Total agricultural production and sales during the 12 months prior to the survey

	1	2	3	4	5	6
	Total crop production[a] (kg)	Proportion reporting increased crop yields since 2009[b] %	Proportion of households making any crop sales %	Total quantity of crops sold[a] (kg)	Total value of crops sold (US$)	Proportion reporting increased income from crop sales since 2009[b] %
Overall						
Intervention group mean:	654	37.6	74.9	89.9	108.7	37.3
Comparison group mean:	312	36.4	44.9	24.2	37.3	25.9
Difference:	342*** (44)	1.1 (3.5)	30.0*** (3.4)	65.7*** (18.3)	71.4*** (10.7)	11.5*** (3.3)
Observations (intervention group):	471	490	490	490	490	490
Observations (total):	960	1010	1013	1013	1012	1010
Basic intervention group						
Intervention group mean:	670	26.4	56.0	64.8	72.0	22.4
Comparison group mean:	313	33.9	39.1	19.3	31.7	23.4
Difference:	357*** (62)	-7.5 (4.7)	16.9*** (5.3)	45.5*** (16.0)	40.3*** (12.9)	-1.0 (4.4)
Observations (intervention group):	126	127	127	127	127	127
Observations (total):	617	649	652	652	651	649
Livestock group						
Intervention group mean:	588	32.4	68.6	89.3	97.3	30.9
Comparison group mean:	344	37.2	46.1	21.6	37.0	25.4
Difference:	246*** (58)	-4.7 (4.4)	22.5*** (4.4)	67.7*** (22.6)	60.3*** (16.0)	5.5 (4.2)
Observations (intervention group):	177	188	188	188	188	188
Observations (total):	638	680	683	683	682	680
Market garden						
Intervention group mean:	710	51.2	94.8	108.5	147.0	55.2
Comparison group mean:	300	38.2	47.5	22.0	36.7	31.7
Difference:	411*** (75)	13.0*** (4.9)	47.3*** (4.2)	86.5** (41.5)	110.2*** (12.5)	23.5*** (4.8)
Observations (intervention group):	165	172	172	172	172	172
Observations (total):	571	602	602	602	601	602

[a] Omits production or sales of cabbages and leaf vegetables, which were not measured in kilograms in the survey.
[b] Respondents' subjective assessment.
Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates bootstrapped with 1000 repetitions.

Of course, the observations that crop production among the project participant households is approximately double that of comparison households and that crop sales are approximately three times greater do not necessarily imply that the project has had a correspondingly large impact on overall household income. To investigate the net impact of the increase in agricultural production and sales, it would be necessary to take account of the costs of producing and marketing the products for which sales were reported. Such a measure would account for costs of inputs, rent for land on which products are grown (or the value of potential alternative uses for the land), and the value of the producers' time taken both to grow the products and to bring them to market. Such an exercise would be very complicated, and accounting for all costs in this way is rarely attempted in practice. Instead, in Section 5.5 we will examine household consumption as a proxy for net household income.

5.4 LIVELIHOOD DIVERSIFICATION

It has been seen in the previous section that the project appears to have had a very significant impact on the volume of crop production and sales among participant households. It is important also to consider whether the project has had any effect on the diversity of livelihood activities carried out by the household. In an area of food and livelihood insecurity, an explicit aim of the project was to encourage a shift from a dependence on one or two livelihood activities to a broader livelihood base.

Column 1 of Table 5.7 shows the average number of livelihood activities in which each household was engaged at the time of the survey. On average, households supported by the project were involved in slightly more livelihood activities. Most of the differences shown in the table are not statistically significant, but the alternative statistical models tested (for which results are not shown in the table) provide more evidence in favour of this result.[4] This therefore provides evidence that the project has encouraged households to diversify their livelihoods activities, at least among those engaged in the livestock and market-garden interventions.

Table 5.7: Households' engagement in livelihood activities

	Number of livelihood activities in which household engages
Overall	
Intervention group mean:	4.28
Comparison group mean:	4.14
Difference:	0.15 (0.10)
Observations (intervention group):	490
Observations (total):	1013
Basic intervention group	
Intervention group mean:	3.90
Comparison group mean:	3.84
Difference:	0.06 (0.14)
Observations (intervention group):	127
Observations (total):	652
Livestock group	
Intervention group mean:	4.56
Comparison group mean:	4.32
Difference:	0.24* (0.13)
Observations (intervention group):	188
Observations (total):	683
Market garden group	
Intervention group mean:	4.25
Comparison group mean:	4.00
Difference:	0.25* (0.14)
Observations (intervention group):	172
Observations (total):	602

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$;
PSM estimates bootstrapped with 1000 repetitions.

Table 5.8: Proportion of household income estimated to come from livelihood activities

	1	2	3	4	5	6
	Farming %	Market gardening %	Rearing livestock %	Casual labour %	Formal employment %	Remittances %
Overall						
Intervention group	31.2	21.2	15.5	15.5	1.8	8.5
Comparison group	29.4	14.4	12.2	22.5	4.8	10.8
Difference:	1.9 (1.3)	6.8*** (1.0)	3.3*** (0.9)	-7.0*** (1.4)	-3.0*** (1.0)	-2.3** (1.0)
Observations (intervention group):	490	490	490	490	490	490
Observations (total):	1013	1013	1013	1013	1013	1013
Basic intervention group						
Intervention group mean:	33.9	16.2	12.4	21.8	1.7	8.2
Comparison group mean:	29.1	10.8	11.3	25.3	5.1	12.2
Difference:	4.7** (2.1)	5.4*** (1.9)	1.1 (1.4)	-3.5 (2.5)	-3.3*** (1.3)	-4.0** (1.7)
Observations (intervention group):	127	127	127	127	127	127
Observations (total):	652	652	652	652	652	652
Livestock group						
Intervention group mean:	30.0	17.3	18.9	15.6	2.2	8.7
Comparison group mean:	30.5	14.1	13.3	19.7	5.4	10.6
Difference:	-0.5 (1.6)	3.2*** (1.2)	5.6*** (1.2)	-4.1** (1.6)	-3.2** (1.3)	-1.9 (1.3)
Observations (intervention group):	188	188	188	188	188	188
Observations (total):	683	683	683	683	683	683
Market garden						
Intervention group mean:	30.7	28.8	14.1	11.1	1.6	8.4
Comparison group mean:	29.9	17.3	12.0	19.2	5.5	9.4
Difference:	0.8 (1.9)	11.5*** (1.6)	2.1* (1.2)	-8.1*** (1.6)	-3.9** (1.7)	-1.0 (1.3)
Observations (intervention group):	172	172	172	172	172	172
Observations (total):	602	602	602	602	602	602

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates bootstrapped with 1000 repetitions.

Table 5.8 shows estimates of the proportion of household income that was derived from various livelihoods activities. These data are derived from a section of the questionnaire in which respondents were asked to allocate 20 stones to their various livelihoods activities, according to the proportion of their household's income that

comes from each activity.[5] In the table, column 1 shows that households supported by the conservation agriculture intervention were deriving a slightly higher proportion of their income from agriculture than were the corresponding comparison households – but it does not appear that this applies to households supported by the livestock or market-garden interventions. On the other hand, respondents across each of the intervention groups reported deriving more of their income from market gardening than did comparison respondents; as expected, this increase was greatest (at approximately 11 percentage points) among the households supported specifically in market gardening.[6] Those supported by the livestock intervention saw some increase in the proportion of their income (approximately six percentage points) derived from livestock, and there is some indication that the market-garden intervention group did so as well.[7]

As the livelihood activities associated with the project have come to contribute a greater proportion of household income, it is clearly of interest to understand which other sources of income have become relatively *less* important. Columns 4 to 6 of Table 5.8 show that the project participants derived less of their income from casual labour, regular employment and remittances than did the comparison households. The difference in income from casual labour ranges across all three of the intervention groups,[8] while the lower importance of remittances appears to be restricted to the basic intervention group.[9] The proportion of households with some income from formal employment was approximately the same (nine per cent) among the project participants and comparison households, but the project participants appear to have derived a lower proportion of their income from such employment.[10]

5.5 OVERALL HOUSEHOLD INCOME

We found in previous sections that households supported by this project produced considerably larger quantities of crops, and generated much higher revenue from crop sales, than did comparison households. Of course, this information does not provide a complete picture about the effect of the project on household income. It does not account, for example, for costs of production, nor for changes in the time that participants devoted to agricultural production and sales as against other livelihood activities. In a context where households generally have multiple livelihood activities, it is possible that a project that has made agricultural activities more productive could have diverted resources from other livelihoods activities. It is important, therefore, to evaluate the effects of the project on household well-being as a whole.

Measuring household income directly is problematic: self-reported measures of total income are generally regarded as unreliable, given the wide variety of activities that households engage in to generate income.[11] For this reason, the survey did not attempt to collect data on total household income directly. However, there is a widely recognised and strong association between household income and consumption.[12] The Effectiveness Review therefore followed common practice in micro-level economic analysis, by considering the value of household consumption as a proxy measure of income.

To that end, respondents were asked to provide detailed information about their recent expenditure on both food and non-food items. Firstly, the respondents were asked what types of food they had consumed over the previous seven-day period, as well as the quantities of each item. These quantities were then converted into a monetary value: this was done by asking the respondent how much was paid for the food item in question or, if the food item was from the household's own production, how much it *would have* cost if it had been purchased from the local market. The respondents were also asked how much they had spent on non-food items over the past month or the past 12 months, as appropriate to the particular item.

The household expenditure measure was calculated by converting each of the expenditure types into a per-day figure and adding them together. This figure was then divided by a factor representing household size, to generate a per-day, per-person expenditure figure.[13] The expenditure variable was then expressed on a logarithmic scale, to reduce the influence on the overall result of any households with extreme values for total consumption. The comparison of expenditure between supported households and comparison households, both before and after logarithmic transformation, is shown in the first two columns of Table 5.9.

Table 5.9: Overall household income

	1	2	3
	Total consumption and expenditure per adult equivalent per day (US$)	Total consumption and expenditure per adult equivalent per day (logarithm of US$)	Global indicator for livelihoods support %
Overall			
Intervention group mean:	2.76	0.89	69.8
Comparison group mean:	2.25	0.65	50.1
Difference:	0.51*** (0.10)	0.24*** (0.04)	19.7*** (3.5)
Observations (intervention group):	490	490	490
Observations (total):	1013	1013	1013
Basic intervention group			
Intervention group mean:	2.49	0.80	61.6
Comparison group mean:	2.19	0.63	48.1
Difference:	0.30** (0.14)	0.17*** (0.05)	13.5** (5.3)
Observations (intervention group):	127	127	127
Observations (total):	652	652	652
Livestock group			
Intervention group mean:	2.72	0.86	68.6
Comparison group mean:	2.43	0.73	56.3
Difference:	0.29** (0.15)	0.13** (0.05)	12.3*** (4.3)
Observations (intervention group):	188	188	188
Observations (total):	682	682	683
Market garden group			
Intervention group mean:	3.01	0.99	76.2
Comparison group mean:	2.25	0.65	48.3
Difference:	0.76*** (0.15)	0.34*** (0.05)	27.9*** (4.8)
Observations (intervention group):	172	172	172
Observations (total):	602	602	602

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates bootstrapped with 1000 repetitions.

It can be seen that household income among intervention households is estimated to be significantly higher than among the comparison households. The estimated difference of 0.24 in the logarithmic measure of consumption (shown in column 2 of the table) implies that project participant households have consumption that is approximately 27 per cent higher on average than comparison households. The difference in terms of food consumption alone (for which data are not shown here) is even larger. The largest apparent effect from the project comes among the households

supported in marketing gardening, for which consumption is estimated to be approximately 40 per cent higher than among comparison households; the differences among the livelihood group and the basic intervention group are lower.

The Oxfam GB global indicator for livelihoods support is derived directly from the per-capita household expenditure measure, by measuring the situation of each household against a 'typical' household in the sample. The indicator is defined to take the value 1 if a household has expenditure per capita per day greater than the median household in the comparison group in the same region, and zero otherwise. As can be seen in column 3 of Table 5.9, 70 per cent of the project participant households reached that threshold, compared to only 50 per cent of the comparison households.

These results imply that household consumption was considerably higher on average among the households of project participants – particularly among the market-gardening group – than among comparison households at the time of the survey. Of course it would be preferable to look at the *change* in the level of household consumption since 2009 to provide more confidence that this difference is a result of the project activities. Unfortunately, detailed consumption data from 2009 are not available. However, an alternative indicator of households' level of material well-being was derived from questions included in the survey about the households' ownership of land, livestock and other assets, as well as about the physical conditions of their house. As well as being asked about their asset ownership and housing conditions now, respondents were also asked to recall what assets they owned and the condition of their house in 2009. This information was used to examine changes in household wealth since that time.

To examine changes in wealth indicators, the data about ownership of particular assets and housing characteristics were aggregated into a single index of material wealth. To do this, they were first checked to see which of the indicators appeared to be good indicators of wealth. If each of the assets and housing characteristics are indicators of household wealth, they should correlate with each other. That is, a household that scores favourably on one particular wealth indicator should be more likely to do so for other wealth indicators. Items that had low correlations or negative correlations with the others were therefore not included in the index.[14]

A data-reduction technique called principal component analysis (PCA) was used to produce the indices of overall material wealth. PCA produces a measure that maximises the variation in asset types by assigning more weight to those assets that are most highly correlated with the inter-item variation. Hence, each household's weighted index score is determined by both the number of assets it owns, and by the weight assigned to each asset type. The resulting index enables the relative wealth status of the households to be compared. After calculating the wealth index for both 2009 and the date of the survey, households were categorised according to the quintile in which they lay – that is, the top 20 per cent of households according to wealth indicators were categorised together, as were those in the next 20 per cent, and so on. The measure reported in Table 5.10 is based on households moving between quintiles. For example, a household that changed from being among the bottom 20 per cent of the sample in 2009 to being in the 20–40 per cent quintile at the time of the survey would be given a score of +1. A household that moved from the middle quintile to the bottom quintile would have a score of –2.

This shows that for intervention households overall, there is a positive and statistically significant difference in the index as compared to the comparison households. This adds weight to the conclusion provided by the consumption and expenditure data that the project has had a positive effect on the income of project participants. The disaggregation of the results by the type of intervention shows a statistically significant positive result among the livestock and market-garden participants, whereas that among those supported only in conservation agriculture is not statistically significant.

Table 5.10: Index of wealth indicators

	Number of quintiles of wealth index in which household increased
Overall	
Intervention group mean:	0.04
Comparison group mean:	-0.08
Difference:	0.13** (0.05)
Observations (intervention group):	490
Observations (total):	1013
Basic intervention group	
Intervention group mean:	-0.03
Comparison group mean:	-0.06
Difference:	0.02 (0.08)
Observations (intervention group):	127
Observations (total):	652
Livestock group	
Intervention group mean:	0.06
Comparison group mean:	-0.09
Difference:	0.15** (0.07)
Observations (intervention group):	188
Observations (total):	683
Market garden group	
Intervention group mean:	0.08
Comparison group mean:	-0.06
Difference:	0.14* (0.08)
Observations (intervention group):	172
Observations (total):	602

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$;
PSM estimates bootstrapped with 1000 repetitions.

5.6 FOOD SECURITY AND DIETARY DIVERSITY

A key objective of the project was to increase food security among supported households. Two separate sections of the survey allow assessment of the project's impact on food security, food consumption and dietary diversity.

Firstly, survey respondents were asked a series of questions intended to identify whether their household had secure access to food at the time of the survey. These questions were based on common indicators of food security, adapted from the Household Food Insecurity Access Scale.[15] Respondents were asked how frequently they and other household members had experienced the following during the four weeks prior to the survey:

- Having to reduce the size of meals because there was not enough food
- Having to eat fewer meals in a day than normal because there was not enough food
- Having to eat poorer quality or less preferred types of food than normal
- Having to reduce the amount eaten so that children could eat
- Having to go to sleep at night hungry because there was not enough food
- Going for a whole day and night without eating because there was not enough food.

Responses to each of these questions were ranked on a scale from zero (meaning that the problem was encountered every day during the four weeks prior to the survey) to three (meaning that the problem was never encountered during those four weeks). A food insecurity score was created by adding together the rankings for incidence of each of the six food security problems. The resulting scores range from zero to 18, with higher scores representing fewer difficulties and hence better food security.

Table 5.11 shows the average food security scores for the project and comparison households. On average, project participants have food security scores one point higher than comparison households, a significant difference. Consistent with the results obtained from the consumption data above, the difference was greatest among the market-garden group, with the differences among the basic intervention group and the livestock group not being clearly statistically significant.

The survey questions were also used to generate an indicator of severe food insecurity – defined as ever having to go to for a whole day and night without eating at least once during the past four weeks, or having experienced any of the other food security problems more than occasionally during that time. The results for this indicator are shown in column 2 of Table 5.11. Just over half of the households surveyed were experiencing severe food insecurity by this standard, a proportion that did not differ between the project and comparison households.

An indication of the diversity of each household's diet was obtained from the detailed data on the household's food consumption during the seven days prior to the survey (discussed in Section 5.5). In column 3 of Table 5.11, households in the project and comparison communities are compared in terms of the range of food types they reported having eaten during the seven-day period. It can be seen that project participants were consuming a significantly more diverse diet than were comparison households. Again the difference is greatest among the households supported in market gardening, but there is a statistically significant difference in the other two intervention groups as well.

Table 5.11: Food security and dietary diversity

	1	2	3
	Food security score[a]	Severe food insecurity %	Number of food types consumed by household in the past seven days[b]
Overall			
Intervention group mean:	13.3	53.1	7.2
Comparison group mean:	12.2	55.3	6.0
Difference:	1.0*** (0.3)	-2.2 (3.5)	1.2*** (0.2)
Observations (intervention group):	486	490	490
Observations (total):	1009	1013	1013
Basic intervention group			
Intervention group mean:	12.8	56.0	6.4
Comparison group mean:	12.1	58.4	5.7
Difference:	0.7 (0.4)	-2.4 (5.2)	0.7** (0.3)
Observations (intervention group):	125	127	127
Observations (total):	650	652	652
Livestock group			
Intervention group mean:	13.3	52.1	7.2
Comparison group mean:	12.8	49.2	6.3
Difference:	0.6 (0.3)	3.0 (4.7)	0.9*** (0.2)
Observations (intervention group):	187	188	188
Observations (total):	681	683	682
Market garden group			
Intervention group mean:	13.5	51.7	7.7
Comparison group mean:	12.6	49.7	6.2
Difference:	0.8** (0.4)	2.1 (5.3)	1.5*** (0.3)
Observations (intervention group):	170	172	171
Observations (total):	599	602	600

[a] On a scale from zero to 18, where higher values represent fewer food security problems.
[b] Including grains and other carbohydrates, dairy products, meat, fish, fruit and vegetables.
Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; PSM estimates bootstrapped with 1000 repetitions.

6 CONCLUSIONS

6.1 CONCLUSIONS

This Effectiveness Review found evidence that the Food Security and Livelihood Programme had a significant positive effect on participant households in several important livelihood and food security characteristics. Despite concerns that a high proportion of the comparison households interviewed had received distributions of agricultural inputs (presumably from other organisations), the positive effects of the project among the participants are nevertheless clear. There is evidence of positive change right through the different steps of the project logic, from adoption of improved agricultural practices, to increased crop production and sales, diversification in livelihood activities, and increased overall household income and food security.

The differences in outcomes between the three intervention groups are instructive. There appear to be large positive impacts among those supported by the project's basic intervention (agricultural inputs and training in conservation agriculture), who produced more than double the quantity of crops than corresponding households in the comparison group. The participants in this component of the project generated much larger income from crop sales than did the comparison households, had a household income approximately 19 per cent higher, and were also eating a more diverse diet. However, there was less evidence among this group of an improvement in food security, and no indication of a change in terms of wealth indicators (asset ownership and housing conditions).

The livestock support and market-garden participants – who received inputs and training in conservation agriculture *as well* as the specific support provided under those two components of the project – were found to have generated even greater gains in agricultural production and sales, and in overall household income. Their increased engagement in livestock rearing and market gardening meant that they had increased the diversification of their income sources over the project's lifetime. Households in the market-garden intervention group demonstrated particularly positive results, with an estimated average income increase of 40 per cent, significant changes in wealth indicators, and improved food security and dietary diversity.

Overall, therefore, these findings demonstrate consistent and impressive evidence that the project has successfully resulted in positive changes in terms of the household-level outcomes it was targeting.

6.2 PROGRAMME LEARNING CONSIDERATIONS

While the findings of the review are positive, there are additional lessons emerging from the results that can be applied to other projects of this type in Zimbabwe and elsewhere. The Zimbabwe country team and the project team in particular are encouraged to consider the following:

Continue to strengthen and build on the success of the project in delivering a 'basket' of interventions

This Effectiveness Review offered an opportunity to not just examine the effectiveness of the project overall, but also the difference in project impact across three interventions. As such, the review has highlighted greatest project impact among those participants who received agricultural inputs and conservation agriculture, *as well as* livestock or communal gardening support. The programme and country team should give this due consideration ahead of future project activity, and seek to roll out, where appropriate, a 'basket' of evidence-based interventions among supported households.

Strengthen the market-linkage work among the communal market-garden project participants

While there is strong evidence of project impact among the market-garden participants, it was interesting to note that only 10 per cent of these producers reported selling their produce to a cooperative. This seems to highlight an opportunity to strengthen this aspect of the project. The programme and country team should consider how this can be improved among the project participants, as well as for future market-development projects.

APPENDIX 1: BASELINE STATISTICS BEFORE MATCHING

		Intervention mean	Comparison mean	Difference	Standard error of difference
Number of household members		5.31	4.80	0.52***	(0.13)
Number of adults in household		2.65	2.42	0.23***	(0.073)
Only one adult in household	%	11.7	15.5	-3.74*	(2.14)
Number of children (less than 5 years old) in household		0.66	0.66	-0.0046	(0.049)
Number of dependents in household		0.86	0.91	-0.046	(0.057)
Number of adults in household fit and able to work		2.42	2.15	0.27***	(0.070)
Household head is female	%	38.3	37.5	0.76	(3.03)
Household head has secondary education	%	47.6	48.9	-1.31	(3.12)
Age of household head	years	52.2	50.6	1.60	(1.00)
Household head is over 60 years old	%	31.0	31.9	-0.93	(2.90)
Household head is fit and able to work	%	88.9	85.1	3.79*	(2.10)
Household head has basic literacy	%	88.5	83.4	5.07**	(2.17)
Proportion of adults in household with secondary education	%	81.2	74.1	7.11***	(2.60)
Productive activities engaged in by household members in 2009:					
Farming	%	97.4	92.2	5.20***	(1.39)
Market gardening	%	74.7	50.0	24.7***	(2.93)
Agricultural processing	%	9.92	7.65	2.27	(1.76)
Rearing livestock	%	80.0	70.5	9.44***	(2.69)
Producing livestock products	%	26.3	23.1	3.18	(2.69)
Non-agricultural household business	%	7.69	11.0	-3.32*	(1.82)
Casual agricultural labour	%	48.8	53.0	-4.20	(3.12)
Casual non-agricultural labour	%	41.3	42.0	-0.68	(3.08)
Unskilled labour	%	7.49	7.28	0.21	(1.63)
Skilled labour	%	4.66	5.97	-1.31	(1.40)
Area of farmland cultivated by household in 2009	hectares	2.06	1.46	0.60***	(0.096)
Household was in the lowest 20% of the sample according to wealth indicators recalled from 2009[a]	%	15.2	24.4	-9.26***	(2.48)
Household was in the second 20% of the sample according to wealth indicators recalled from 2009[a]	%	17.6	22.2	-4.59*	(2.49)
Household was in the middle 20% of the sample according to wealth indicators recalled from 2009[a]	%	22.1	18.1	3.97	(2.49)
Household was in the fourth 20% of the sample according to wealth indicators recalled from 2009[a]	%	21.9	18.3	3.58	(2.49)
Household was in the upper 20% of the sample according to wealth indicators recalled from 2009[a]	%	23.3	17.0	6.30**	(2.49)
Observations		**494**	**536**	**1030**	

[a] The construction of the wealth index is described in Section 5.5.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Variables are estimates, based on recall data or reconstructed from the composition of the household at the time of the survey.

APPENDIX 2: METHODOLOGY USED FOR PROPENSITY-SCORE MATCHING

The analysis of outcome variables, as presented in Section 5 of this report, involved group mean comparisons using propensity-score matching (PSM). The basic principle of PSM is to match each participant with a non-participant that was observationally similar at baseline and to obtain the treatment effect by averaging the differences in outcomes across the two groups after project completion. Unsurprisingly, there are different approaches to matching, i.e. to determining whether or not a household is observationally 'similar' to another household. For an overview, we refer to Caliendo and Kopeinig (2008).[16] This appendix describes and tests the specific matching procedure followed in this Effectiveness Review.

The process described in this appendix was followed to create a model for the overall sample of households supported by the project, as well as three separate models for the three specific intervention groups. Full details are shown only for the overall model.

Estimating propensity scores

Given that it is extremely hard to find two individuals with exactly the same characteristics, Rosenbaum and Rubin (1983)[17] demonstrate that it is possible to match individuals using a prior probability for an individual to be in the intervention group, naming it *propensity score*. More specifically, propensity scores are obtained by pooling the units from both the intervention and comparison groups and using a statistical probability model (e.g. a logit regression) to estimate the probability of participating in the project, conditional on a set of observed characteristics.

Tables A2.1 and A2.2 present the logit regression results used to estimate the propensity scores in our context. **Error! Reference source not found.**Table A2.1 shows the logit results for the non-parsimonious models entering the full set of matching variables considered in this study, both for the overall sample and for each of the three intervention groups. To guarantee that none of the matching variables were affected by the intervention, we only considered variables related to baseline, and only those variables that were unlikely to have been influenced by anticipation of project participation (Caliendo and Kopeinig, 2008).

Table A2.1: Estimating the propensity score: non-parsimonious model for overall sample

	Coefficient	Standard error	*p*-value
Number of household members	0.119	(0.049)	0.016
Number of adults in household	-0.072	(0.489)	0.882
Only one adult in household = 1	-0.059	(0.267)	0.826
Number of children <5 in household	0.163	(0.476)	0.732
Number of dependents in household	-0.241	(0.467)	0.606
Number of adults in household fit and able to work	0.009	(0.492)	0.985
Household head is female = 1	0.143	(0.175)	0.415
Household head has secondary education = 1	-0.155	(0.197)	0.432
Age of household head years	0.013	(0.009)	0.139
Household head is over 60 years old = 1	-0.331	(0.254)	0.192
Household head is fit and able to work = 1	0.098	(0.347)	0.778
Household head has basic literacy = 1	0.340	(0.228)	0.136
Number of adults in household with secondary	0.435	(0.226)	0.055

	Coefficient	Standard error	*p*-value
education			
Some household member(s) engaged in farming in 2009 = 1	0.059	(0.366)	0.872
Some household member(s) engaged in market gardening in 2009 = 1	1.036	(0.149)	0.000
Some household member(s) engaged in agricultural processing in 2009 = 1	0.256	(0.248)	0.302
Some household member(s) engaged in rearing livestock in 2009 = 1	0.132	(0.180)	0.464
Some household member(s) engaged in producing livestock products in 2009 = 1	-0.040	(0.171)	0.813
Some household member(s) engaged in a non-agricultural household business in 2009 = 1	-0.480	(0.240)	0.045
Some household member(s) engaged in casual agricultural labour in 2009 = 1	-0.347	(0.151)	0.022
Some household member(s) engaged in casual non-agricultural labour in 2009 = 1	-0.096	(0.146)	0.511
Some household member(s) engaged in unskilled labour in 2009 = 1	0.082	(0.265)	0.757
Some household member(s) engaged in skilled labour in 2009 = 1	-0.238	(0.308)	0.440
Area of farmland cultivated by household in 2009 hectares	0.235	(0.057)	0.000
Household was in the second 20% of the sample according to wealth indicators recalled from 2009 = 1	-0.032	(0.225)	0.887
Household was in the middle 20% of the sample according to wealth indicators recalled from 2009 = 1	0.337	(0.228)	0.139
Household was in the fourth 20% of the sample according to wealth indicators recalled from 2009 = 1	0.219	(0.236)	0.354
Household was in the upper 20% of the sample according to wealth indicators recalled from 2009 = 1	0.196	(0.255)	0.443
Number of observations	**1029**		

Notes: Logit regression. Variables are estimates, based on recall data or reconstructed from the composition of the household at the time of the survey. Explanatory variables expressed as $x = 1$ represent binary variables taking values of either 0 or 1. The dependent variable is 1 if the household is in the intervention group, and 0 if the household is in the comparison group. The coefficients represent the contribution of each explanatory variable/characteristic to the probability that a household participates in the project.

The final set of variables used in the matching process was identified using a backwards stepwise regression to identify those variables correlated with being in an intervention group at *p*-values of 0.20 or less. For the overall sample, 12 such variables were identified. (Between nine and 13 such variables were found in developing the PSM models for each of the three specific project interventions.) Table A2.2 shows the results of the logit model restricted to this final (restricted) set of matching variables.

Table A2.2: Estimating the propensity score: parsimonious model for overall sample

	Coefficient	Standard error	*p*-value
Number of household members	0.116	(0.041)	0.004
Number of dependents in household	-0.155	(0.086)	0.071
Household head is female = 1	0.212	(0.146)	0.147
Age of household head years	0.014	(0.008)	0.066
Household head is over 60 years old = 1	-0.334	(0.248)	0.179
Household head has basic literacy = 1	0.427	(0.217)	0.049
Number of adults in household with secondary education	0.307	(0.176)	0.081
Some household member(s) engaged in market gardening in 2009 = 1	1.087	(0.144)	0.000
Some household member(s) engaged in a non-agricultural household business in 2009 = 1	-0.478	(0.234)	0.041
Some household member(s) engaged in casual agricultural labour in 2009 = 1	-0.348	(0.140)	0.013
Household was in the middle 20% of the sample according to wealth indicators recalled from 2009 = 1	0.250	(0.168)	0.138
Area of farmland cultivated by household in 2009 hectares	0.244	(0.055)	0.000
Number of observations	**1029**		

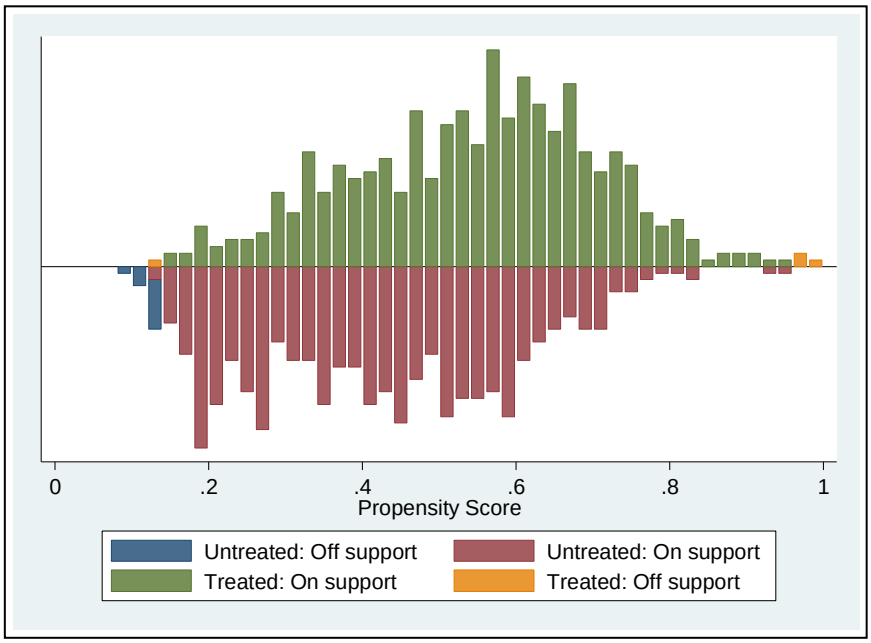
Notes: Logit regression. Variables are estimates, based on recall data or reconstructed from the composition of the household at the time of the survey. Explanatory variables expressed as $x = 1$ represent binary variables taking values of either 0 or 1. The dependent variable is 1 if the household is in the intervention group, and 0 if the household is in the comparison group. The coefficients represent the contribution of each explanatory variable/characteristic to the probability that a household participates in the project.

Defining the region of common support

After estimating the propensity scores, the presence of a good *common support area* needs to be checked. The area of common support is the region where the propensity score distributions of the treatment and comparison groups overlap. The common support assumption ensures that 'treatment observations have a comparison observation "nearby" in the propensity score distribution' (Heckman, LaLonde and Smith, 1999[18]). Since some significant differences were found between the intervention and comparison groups in terms of their baseline characteristics (as shown in Appendix 1), some of the households in the intervention group are too different from the comparison group to allow for meaningful comparison. We used a minima and maxima comparison, deleting all observations whose propensity score is smaller than the minimum and larger than the maximum in the opposite group (Caliendo and Kopeinig, 2008). In the overall sample, four of the 494 intervention households and 13 of the 536 comparison households surveyed were dropped because they lay outside the area of common support. The fact that fewer than one per cent of observations were dropped is positive for the representativeness of the results: it means that the estimates of differences in outcome characteristics between the treatment groups apply to more than 99 per cent of those the intervention households that were surveyed. (A number of intervention households were also dropped in developing the PSM models for the specific project interventions: three intervention households were dropped in the model for the livestock support intervention, and five in the model for the market gardening intervention. None were dropped in the model for the basic conservation agriculture intervention.)

Figure A2.1 illustrates the propensity scores and shows the proportion of households lying on and off the areas of common support, by treatment group.

Figure A2.1: Propensity score on and off area of common support



Matching intervention households to comparison households

Following Rosenbaum and Rubin (1983), after estimating the propensity scores and defining the area of common support, households are matched on the basis of their propensity score. The literature has developed a variety of matching procedures. For the main results presented in this Effectiveness Review we chose to employ the method of kernel matching (but note that we used alternative matching procedures as a means of robustness checks). Kernel matching weights the contribution of each comparison group member, attaching greater weight to those comparison observations that provide a better match with the treatment observations. One common approach is to use the normal distribution with mean zero as a kernel, and weights given by the distribution of the differences in propensity score. Thus 'good' matches are given greater weight than 'poor' matches.

We used the *psmatch2* module in Stata using the default bandwidth of 0.06, and restricted the analysis on the area of common support. When using PSM, standard errors of the estimates were bootstrapped using 1000 repetitions (clustered by community), to account for the additional variation caused by the estimation of the propensity scores and the determination of the common support.[19]

Check balancing

For PSM to be valid, the intervention group and the matched comparison group need to be balanced, in that they need to be similar in terms of their observed baseline characteristics. This should be checked. The most straightforward method to do this is to test whether there are any statistically significant differences in baseline covariates between the intervention and comparison group in the matched sample. Efforts were made to ensure that the covariates were balanced across groups at *p*-values greater than 0.20. The balance of each of the matching variables after kernel matching is shown in Table A2.3. None of the variables implemented for the matching are statistically significant in the matched sample.

Table A2.3: Balancing test on the restricted set of matching variables

	Treated	Untreated	*p*-value
Number of household members	5.312	5.245	0.615
Number of dependents in household	0.857	0.821	0.527
Household head is female = 1	0.382	0.383	0.955
Age of household head years	52.171	52.220	0.959
Household head is over 60 years old = 1	0.308	0.302	0.823
Household head has basic literacy = 1	0.888	0.894	0.769
Number of adults in household with secondary education	0.812	0.818	0.815
Some household member(s) engaged in market gardening in 2009 = 1	0.749	0.746	0.904
Some household member(s) engaged in a non-agricultural household business in 2009 = 1	0.078	0.076	0.913
Some household member(s) engaged in casual agricultural labour in 2009 = 1	0.490	0.508	0.560
Household was in the middle 20% of the sample according to wealth indicators recalled from 2009 = 1	0.220	0.227	0.806
Area of farmland cultivated by household in 2009 hectares	1.982	1.939	0.650
Number of observations	**490**	**523**	

Notes: Variables are estimates, based on recall data or reconstructed from the composition of the household at the time of the survey. Explanatory variables expressed as *x* = 1 represent binary variables taking values of either 0 or 1.

The left-hand columns of Table A2.4 shows that the balancing tests are also passed when using the full (unrestricted) set of matching variables. Only two variables in the complete set are unbalanced with *p*-values of less than 0.2.

Table A2.4 also shows the balancing tests for the full set of matching variables used in the PSM models for the three specific project interventions. None of the matching variables are unbalanced with *p*-values of less than 0.2 in any of the three models.

Table A2.4: Estimating the propensity score: non-parsimonious models

	Overall sample			Agricultural inputs/CA			Livestock support			Communal garden		
	Treated	**Untreated**	***p*-value**	**Treated**	**Untreated**	***p*-value**	**Treated**	**Untreated**	***p*-value**	**Treated**	**Untreated**	***p*-value**
Number of household members	5.312	5.245	0.615	5.240	5.252	0.962	5.193	5.150	0.848	5.368	5.370	0.996
Number of adults in household	2.645	2.658	0.868	2.480	2.519	0.775	2.674	2.652	0.871	2.673	2.711	0.768
Only one adult in household = 1	0.118	0.128	0.642	0.120	0.120	1.000	0.144	0.140	0.909	0.094	0.118	0.468
Number of children <5 in household	0.657	0.608	0.319	0.696	0.716	0.842	0.551	0.534	0.828	0.719	0.678	0.636
Number of dependents in household	0.857	0.821	0.527	0.872	0.950	0.503	0.733	0.717	0.860	0.942	0.917	0.813
Number of adults in household fit and able to work	2.422	2.429	0.933	2.280	2.273	0.957	2.471	2.457	0.913	2.427	2.462	0.787
Household head is female = 1	0.382	0.383	0.955	0.432	0.372	0.336	0.401	0.397	0.933	0.327	0.327	0.992
Household head has secondary education = 1	0.478	0.498	0.529	0.440	0.453	0.840	0.471	0.464	0.902	0.515	0.575	0.261
Age of household head years	52.171	52.220	0.959	51.112	51.390	0.888	52.556	52.947	0.794	52.234	51.031	0.449
Household head is over 60 years old = 1	0.308	0.302	0.823	0.280	0.291	0.854	0.316	0.343	0.572	0.316	0.303	0.794
Household head is fit and able to work = 1	0.892	0.883	0.656	0.904	0.890	0.717	0.888	0.900	0.710	0.883	0.882	0.982
Household head has basic literacy = 1	0.888	0.894	0.769	0.912	0.916	0.921	0.888	0.848	0.260	0.866	0.877	0.748
Number of adults in household with secondary education	0.812	0.818	0.815	0.832	0.837	0.921	0.786	0.762	0.578	0.813	0.822	0.832
Some household member(s) engaged in farming in 2009 = 1	0.973	0.976	0.773	0.960	0.955	0.849	0.968	0.965	0.887	0.994	0.995	0.893
Some household member(s) engaged in market gardening in 2009 = 1	0.749	0.746	0.904	0.544	0.518	0.676	0.727	0.730	0.959	0.918	0.907	0.727
Some household member(s) engaged in agricultural processing in 2009 = 1	0.100	0.077	0.211	0.040	0.042	0.931	0.150	0.130	0.588	0.082	0.074	0.775
Some household member(s) engaged in rearing livestock in 2009 = 1	0.802	0.801	0.979	0.736	0.741	0.936	0.904	0.920	0.569	0.737	0.754	0.723
Some household member(s) engaged in producing livestock products in 2009 = 1	0.265	0.267	0.964	0.192	0.233	0.427	0.364	0.337	0.589	0.211	0.228	0.698
Some household member(s) engaged in a non-agricultural household business in 2009 = 1	0.078	0.076	0.913	0.056	0.056	0.996	0.086	0.117	0.320	0.088	0.118	0.363
Some household member(s) engaged in casual agricultural labour in 2009 = 1	0.490	0.508	0.560	0.440	0.436	0.954	0.562	0.565	0.952	0.462	0.480	0.740
Some household member(s) engaged in casual non-agricultural labour in 2009 = 1	0.416	0.470	0.091	0.536	0.537	0.982	0.439	0.461	0.666	0.310	0.319	0.851
Some household member(s) engaged in unskilled labour in 2009 = 1	0.073	0.067	0.693	0.040	0.066	0.355	0.102	0.087	0.630	0.070	0.049	0.408
Some household member(s) engaged in skilled labour	0.045	0.056	0.442	0.048	0.059	0.713	0.053	0.068	0.549	0.041	0.060	0.423

	Overall sample			Agricultural inputs/CA			Livestock support			Communal garden		
	Treated	**Untreated**	***p*-value**	**Treated**	**Untreated**	***p*-value**	**Treated**	**Untreated**	***p*-value**	**Treated**	**Untreated**	***p*-value**
in 2009 = 1												
Area of farmland cultivated by household in 2009 hectares	1.982	1.939	0.650	1.890	1.840	0.759	1.944	1.882	0.661	1.934	1.850	0.594
Household was in the second 20% of the sample according to wealth indicators recalled from 2009 = 1	0.176	0.214	0.133	0.216	0.230	0.791	0.166	0.184	0.649	0.158	0.195	0.369
Household was in the middle 20% of the sample according to wealth indicators recalled from 2009 = 1	0.220	0.227	0.806	0.224	0.185	0.449	0.171	0.164	0.858	0.275	0.310	0.483
Household was in the fourth 20% of the sample according to wealth indicators recalled from 2009 = 1	0.216	0.194	0.380	0.192	0.177	0.768	0.257	0.261	0.922	0.199	0.169	0.471
Household was in the upper 20% of the sample according to wealth indicators recalled from 2009 = 1	0.235	0.214	0.442	0.152	0.206	0.270	0.273	0.266	0.879	0.240	0.209	0.492
Number of observations	**490**	**523**		**125**	**525**		**187**	**494**		**171**	**429**	

Notes: Variables dated 2009 are estimates, based on recall data or reconstructed from the composition of the household at the time of the survey. Explanatory variables expressed as *x* = 1 represent binary variables taking values of either 0 or 1.

NOTES

1 Original map: 'Zimbabwe admin' by Jackaranga – Own work. Licensed under Creative Commons Attribution-Share Alike 3.0-2.5-2.0-1.0 via Wikimedia Commons - http://commons.wikimedia.org/wiki/File:Zimbabwe_admin.svg#mediaviewer/File:Zimbabwe_admin.svg

2 This approach was taken primarily because it is not clear how to account for sample weights in applying propensity-score matching.

3 The difference-in-difference measure for the overall sample is estimated to be positive and statistically significant at the 10 per cent level under each of the statistical models tested. The difference-in-difference estimates among the three different intervention sub-groups are all positive, but are generally not estimated to be statistically significant.

4 The results for a parametric PSM model and various regression models for this outcome measure are all statistically significant at the 1 per cent confidence level, for the overall group and for the livestock and market-garden intervention groups. Respondents were also asked to recall the livelihoods activities they were engaged in during 2009, allowing the change in livelihood diversification since that time to be analysed. The difference-in-difference measure for the number of activities engaged in by each household was estimated to be positive and statistically significant at at least the 10 per cent level for the overall sample and for the livestock and market-garden intervention groups. However, the difference-in-difference measure for the basic intervention group was not consistently estimated to be positive.

5 Following this exercise, respondents were then asked to repeat the process based on their recall of the proportions of household income coming from each activity during 2009. However, little weight has been put on the resulting data in this report, because of the potential for recall error in such detailed data.

6 Difference-in-difference measures, constructed using the recalled baseline data discussed in note 4, produce estimates that are not statistically significant among the basic intervention or livelihood intervention groups. The difference-in-difference estimates among the market-garden intervention group are smaller than the single difference estimates shown in column 3 of Table 5.4, but they remain positive and statistically significant at at least the 5 per cent confidence level.

7 The difference in proportion of income derived from rearing livestock between the market-garden intervention and comparison households is estimated to be positive and statistically significant at at least the 10 per cent level under each of the PSM and linear regression models tested. However, a difference-in-difference measure, constructed using the recalled baseline data discussed in note 4, is not estimated to be positive or statistically significant.

8 The estimates derived from the parametric PSM model and the linear regression models are negative and statistically significant at at least the 5 per cent level, even for the basic intervention group. However, it should be noted that the difference-in-difference measures derived from the baseline recall data discussed in note 4 are not consistently estimated to be negative or statistically significant, neither among the overall sample nor any of the three intervention sub-groups.

9 On the other hand, the difference-in-difference measure is negative and statistically significant at the 5 per cent level only among the livestock intervention group, and not the basic or market-garden intervention groups.

10 There is no evidence of a difference between the project participants and comparison households in the proportion of income derived from two less important sources: non-agricultural household businesses and support from other community members.

11 Saul S. Morris, Carletto Calogero, John Hoddinott and Luc J. M. Christiaensen, 'Validity of rapid estimates of household wealth and income for health surveys in rural Africa', *Journal of Epidemiology and Community Health*, vol. 54(5) (2000), pages 381–387.

12 See, for example, Damodar N. Gujarati, *Basic Econometrics* (fourth edition, New York: McGraw Hill, 2003).

13 To reflect the existence of economies of scale within households, and the lower consumption needs of children, the formula used for calculating household size is , where A is number of adults in the household; K is the number of children; is the consumption of a child relative to an adult; and stands for the extent of economies of scale. This Effectiveness Review follows the common practice of setting equal to 0.33 and equal to 0.9, but the findings are not sensitive to reasonable changes in these parameters.

14 Cronbach's alpha was used to measure this inter-item correlation. The Cronbach's alpha obtained for all the indicators for the recalled 2009 data was 0.77. The alpha derived for the index of change in wealth indicators was originally 0.88, and was increased to 0.90 by removing those items that had a low correlation with the others.

15 Jennifer Coates, Anne Swindale and Paula Bilinksy, Household Food Insecurity Access Scale (HFIAS) for Measurement of Food Access: Indicator Guide, version 3, Food and Nutrition Technical Assistance Project (FANTA), August 2007: http://www.fantaproject.org/monitoring-and-evaluation/household-food-insecurity-access-scale-hfias

16 Marco Caliendo and Sabine Kopeinig ‘Some Practical Guidance for the Implementation of Propensity Score Matching’, *Journal of Economic Surveys*, vol. 22(1) (2008), pages 31–72.

17 Paul R. Rosenbaum and Donald B. Rubin, ‘The Central Role of the Propensity Score in Observational Studies for Causal Effects’, *Biometrika*, vol. 70(1) (1983), pages 41–55.

18 James J. Heckman, Robert J. Lalonde and Jeffrey A. Smith, ‘The Economics and Econometrics of Active Labor Market Programs’, *Handbook of Labor Economics*, vol. 3, part A (1999), pages 1865–2097.

19 Bootstrapping is a statistical procedure where repeated samples are drawn from the original sample with replacement. This results in a statistical distribution of parameter estimates (the sampling distribution). The bootstrapped standard error is the standard deviation of this sampling distribution and it can be shown that as the number of repeated samples becomes large, provided certain technical conditions are met, this is a good estimate for the standard error of the estimate.

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