# Drought Management Initiative: Livestock Component

# Project Effectiveness Review

## *Full Technical Report*

**Oxfam GB**
**Adaptation and Risk Reduction Outcome Indicator**

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Photo credit: Alejandro Chaskielberg

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## Executive summary

Under Oxfam Great Britain's (OGB) Global Performance Framework (GPF), samples of sufficiently mature projects are being randomly selected each year and their effectiveness rigorously assessed. The livestock component of the Turkana-Pokot Drought Management Initiative (DMI) was randomly selected for an Effectiveness Review under the adaptation and risk reduction thematic area in the 2012/13 financial year. DMI was a three-year programme implemented by a consortium of NGOs which aimed to mitigate the effects of climatic shocks among pastoralist communities in north-western Kenya. Oxfam GB was responsible for implementing the livestock component of this programme in three of the most remote pastoralist communities in the northern part of Turkana County. The activities carried out included establishing pastoralist field schools (PFSs) in each community, to provide members with training on improving livestock management, drought mitigation, and livelihood diversification. In the same communities, the project supported the establishment of village community banks (VICOBAs), as well as training community animal-health workers (CAHWs) and setting up village land-use planning committees (VLUPCs).

To assess the effectiveness of this project, a quasi-experimental impact evaluation was implemented. This involved carrying out surveys with households in the three communities supported by the DMI livestock project, as well as with households in three nearby comparison communities. In all, surveys were carried out with 509 households, including households belonging to the PFS and VICOBA groups directly supported by Oxfam, as well as a sample of households from the wider population in the communities. At the analysis stage, the statistical tools of propensity-score matching and multivariable regression were used to control for demographic and baseline differences between the intervention and comparison groups. The imperfect nature of the comparison in this case complicated the process of making inferences about the project's effects, but some conclusions can be drawn with reasonable confidence.

The results provide evidence that the DMI Livestock project had a modest but positive effect on the resilience of households of members of the PFS and VICOBA groups. Despite the project activities having ended more than one year prior to the survey, the majority of PFS and VICOBA members report that regular meetings and training had continued. These group members appear to have more positive attitudes towards innovation and have, in fact, diversified their livelihoods activities since the launch of the DMI Livestock project more than members of the comparison groups. This appears to have had significant positive effects on indicators of household wealth and food security. Overall, approximately 15 to 23 per cent more of the members of the PFS and VICOBA groups scored positively on Oxfam GB's global indicator for adaptation and risk reduction than did the members of groups in comparison communities. However, it is not clear that there had been any effect on the level of resilience among the wider population in the three project communities.

Respondents among the general population in general and the PFS members in particular, also reported improved access to veterinary care from CAHWs in the three project communities,. The number of water sources available for livestock was also reported to have increased more among residents of the project communities than in the comparison communities – probably a result of interventions carried out under the water component of DMI. On the other hand, there is no evidence that the population in the project communities are more involved in, or more aware of, community efforts for land-use planning.

Oxfam in general, and the Turkana programme team in particular, are encouraged to consider the following points as a follow-up to this Effectiveness Review:

- Keep monitoring progress of the PFS and VICOBA groups, particularly whether the training and skills provided are eventually disseminated among the wider community.
- Explore whether the model used for community land-use planning structures was the right one to achieve sustainable improvements.

# 1 Introduction and purpose

*This report documents the findings of a project Effectiveness Review, focusing on outcomes related to risk reduction and adaptation to climate change.*

Oxfam GB has developed a Global Performance Framework (GPF) as part of its effort to better understand and communicate its effectiveness and enhance learning across the organisation. This framework requires programme/project teams to annually report generic output data across six thematic indicator areas. In addition, modest samples of sufficiently mature projects (e.g. those closing during a given financial year) associated with each thematic indicator area are being randomly selected each year and rigorously evaluated. One key focus is the extent to which they have promoted change in relation to relevant OGB global outcome indicators. The global outcome indicator for the adaptation and risk reduction thematic area is defined as the percentage of households demonstrating greater ability to minimise risk from shocks and adapt to emerging trends and uncertainty, compared to a 'typical' comparison household. This indicator is explained in more detail in Section 3 below.

The Effectiveness Review which took place in northern Turkana County in July 2012 intended to evaluate the success of the Livestock Component of the Turkana-Pokot Drought Management Initiative in promoting resilience to climatic shocks among pastoralist households. The Drought Management Initiative (DMI) was a three-year programme, implemented between May 2008 and April 2011, which was funded by the European Commission and implemented by a consortium of international NGOs, including Vétérinaires Sans Frontières (VSF) Belgium, VSF Germany, ACTED, Practical Action and Oxfam GB. The five implementing organisations all adopted the same approach, but in different geographic areas. Oxfam GB took responsibility for implementing DMI in the northern part of Turkana County.

Four specific activities were implemented under the DMI Livestock project in the three communities:

- Pastoralist Field Schools (PFSs) were established to provide training to their members on livestock management and risk-reduction strategies. Participants in these schools meet regularly and work through a defined 40-week programme of practical training. The majority of members are women. The intention is that the learning gained by members of the PFSs will be disseminated to others in the community; that is, upon graduation from a PFS, it is hoped that some members will become leaders in the PFS themselves, or even establish their own groups to provide training to a further cohort of learners.
- Village community banks (VICOBAs) are local savings and loans groups, intended to provide a sustainable mechanism for saving and providing credit in these isolated communities. Like the PFSs, the VICOBA groups also meet regularly, and members have received training on business skills and financial management. The majority of members of the VICOBA groups are also members of the PFS, and vice versa.
- Village land-use planning committees (VLUPCs) were established to provide an inclusive platform for the discussion of land-use issues within communities, coordinate with other communities, and facilitate the dissemination of seasonal forecasting and early-warning information.
- Finally, a number of community animal health workers (CAHWs) were trained in the project communities. These CAHWs are

community members who are trained to provide basic veterinary care to their neighbours on a commercial basis.

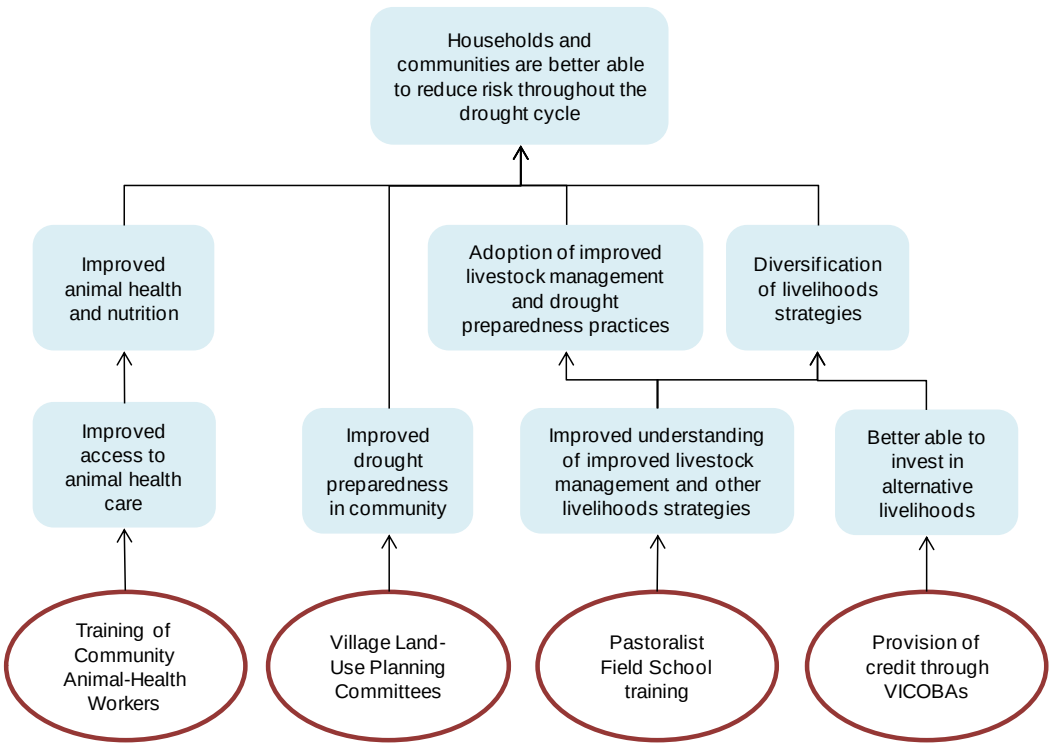
It is important to note that the DMI programme also included a water component, which was implemented concurrently and for which Oxfam GB was the lead agency. This involved improving access to water for pastoralists, including by drilling boreholes and rehabilitating existing wells. The water component was not limited to the communities in which Oxfam GB implemented the livestock component, and thus it is not formally covered by the results of this Effectiveness Review.

This report presents the findings of the project Effectiveness Review. Section 2 begins by reviewing the intervention logic of the DMI Livestock project, and Section 3 follows by introducing the framework for measuring resilience that was adopted. Section 4 then goes on to describe the evaluation design, while Section 5 describes how this design was implemented. Section 6 thereafter presents the results of the data analysis, including the descriptive statistics on the population surveyed and the differences in outcome measures between the intervention and comparison groups. Section 7 concludes the document with a summary of the findings and some programme learning considerations.

# 2 Intervention logic of the DMI Livestock Project

Figure 2.1 shows a simple characterisation of the theory of change behind the project activities. The project's overall objective was to strengthen the capacity of communities and households to manage risk throughout the drought cycle. The training of community animal-health workers contributes to this through building the health and nutrition of

**Figure 2.1: Intervention Logic**



livestock. The village land-use planning committees provided a forum to discuss land-use issues and coordinate with other communities, as well as to facilitate the dissemination of seasonal forecasting and early-warning information.

The pastoralist field schools (PFSs) enrolled groups of individuals in each community in an intensive programme of training, on livestock management, drought preparedness, and alternative livelihoods strategies. These activities are clearly intended to build the resilience of households to withstand drought. Complementing this, the village community banks (VICOBAs) have provided credit to enable adoption of alternative livelihoods strategies, in order that households can diversify their activities.

An important element of the PFS philosophy is that members not only put the knowledge which they have gained into use themselves, but that they should communicate this learning to others in the community. To the extent that that is successful, the PFS intervention should contribute to the resilience not only of members, but also of the wider community. On completing the PFS training programme, members are even encouraged to establish new PFS groups themselves, in order to pass on what they have learned to a new generation of PFS members.

*The 'characteristic approach' assumes that households that are better able to cope with shocks and adapt to change possess particular attributes.*

# 3 The global indicator for Adaptation and Risk Reduction

## 3.1 Introduction to the ARR outcome indicator

As part of Oxfam GB's (OGB) Global Performance Framework, efforts are being undertaken to develop an innovative approach to measuring the resilience of households to shocks and stress and their ability to adapt to change. This approach involves capturing data on various household and community characteristics falling under the five interrelated dimensions presented in Figure 3.1. Following the Alkire-Foster method used in the measurement of multidimensional poverty[1], a binary cut-off is defined for each characteristic. A household is considered to be fairing well in relation to the characteristic if it is above this cut-off and not well if below. Weighted indices, described further in Section 6, are then developed from these binary indicators. These indices can be used as continuous outcome measures in statistical analysis. Alternatively, binary outcome variables can be created by defining cut-off points for the index, with 1 specified for households that have surpassed this threshold and 0 for those below it. For OGB's global Adaptation and Risk Reduction (ARR) outcome indicator, the binary version of this indicator is defined as follows:

- **proportion of targeted households demonstrating greater ability to minimise risk from shocks and adapt to emerging trends and uncertainty**

The term *greater ability* appears in the wording of the indicator because of how it is computed in practice. Specifically, a household is coded with 1 if it is above the median of the comparison group in relation to the Alkire-Foster Resilience Index and 0 if otherwise. Thus, households

[1] Alkire, S. & Foster, J. (2011), Counting and multidimensional poverty measurement. *Journal of Public Economics,* 95**,** 476-487.

demonstrating greater ability are those that are above the typical household of the comparison group in relation to this index.

*The characteristics are context-specific but are informed by a framework consisting of five distinct dimensions.*

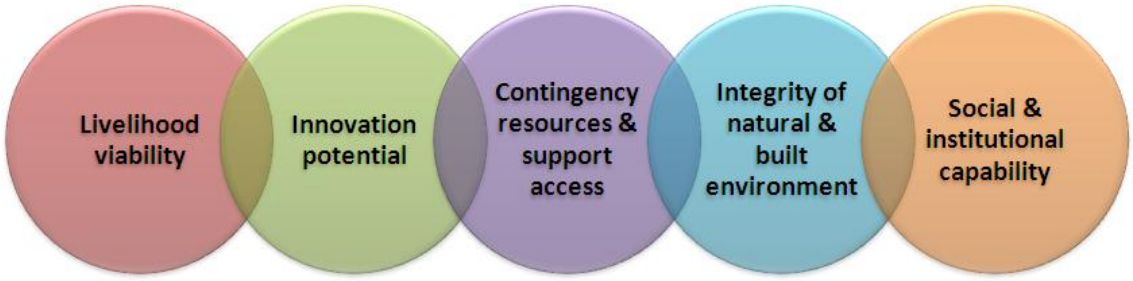
One reason that measuring concepts such as resilience and adaptive capacity is complicated is because we can only really assess whether a system has successfully coped or adapted after the fact.[2] In other words, we would have to wait until after a disaster has struck and/or climatic change has taken place in order to assess the effectiveness of the intervention in question.

The characteristic approach attempts to get around this issue by hypothesising that there are particular characteristics of households (and even communities, organisations, governments, etc.) that affect how well they are able to cope with shocks and positively adapt to change. A limitation, of course, is that we do not know for certain how relevant these characteristics actually are; rather, we assume they are important based on common sense, theory, and/or field experience. However, there is nothing preventing them from being informed by stronger empirical evidence and/or community consultation. It is further recommended that they be continuously updated, as the body of research on the determinants of resilience and adaptive capacity grows.

The characteristics that inform the ARR indicator fall under the five dimensions presented in Figure 3.1. First, if we think about what a household would need in order to cope with current and future shocks, stresses, and uncertainly, a viable livelihood is likely to be one of them. If a shock happens, a household dependent on just one

**FIGURE 3.1.1:**

**Dimensions affecting the ability of households and communities to minimise risks from shocks and adapt to emerging trends and uncertainty**




| Livelihood viability | Innovation potential | Contingency resources & support access | Integrity of natural & built environment | Social & institutional capability |
|---|---|---|---|---|
| *Extent livelihood strategies can thrive in spite of shocks, stresses, and uncertainty* | *Ability to take appropriate risks and positively adjust to change* | *Access to back up resources and appropriate assistance in times of crisis* | *Health of local ecosystems, soundness of natural resource management practices, and robustness of essential physical infrastructure* | *Extent formal & informal institutions are able to reduce risk, support positive adaptation, and ensure equitable access to essential services in times of shock/stress.* |

[2] Dodman, D., Ayers, J. and Huq, S. (2009), 'Building Resilience', Chapter 5, in World Watch Institute (ed), *'2009 State of the World: Into a Warming World'*, Washington D.C: World Watch Institute, pp. 151-168.

precarious livelihood activity will probably be more negatively affected than another that has one or more less sensitive alternatives to fall back on, *all other things being equal*. In addition, households that are on the margins of survival are less likely to be resilient than their relatively wealthier counterparts. Where longer-term climatic trend prediction information exists, it is also important to assess how viable current livelihood strategies would be given the range of likely future climatic scenarios.

Innovation potential is different and hence separate. It is focused on a household's ability to positively adjust to change, whether anticipated or not. We can hypothesise that such potential is dependent on factors such as the knowledge and attitudes of relevant household members themselves, their ability to take risks, and their access to weather prediction, market information, and relevant technology and resources.

Moreover, there are likely to be times when even households with the most 'resilient' and adaptive livelihood strategies will find it tough to get by. Access to contingency resources and external support – e.g. savings, food and seed reserves, social protection, kin and non-kin support networks, emergency services, etc. – are, therefore, likely to be critical in supporting households in coping with shocks and positively adjust to change.

It is further recognised that healthy ecosystems are better able to cope/adjust to climatic shocks/change than those that are relatively more degraded.[3] We may reasonably assume – again, with all other things being equal – that households whose livelihoods are dependent on healthier ecosystems will be in a better position to adjust to climatic shocks/change than those that are not. The presence of appropriate infrastructure (e.g. pit latrines and roads) that is resilient to shocks and stresses (e.g. flooding) is equally important; if critical infrastructure no longer functions or collapses in times shocks and stress, the livelihoods and/or health of community members can be negatively affected.

In most, if not all cases, it is necessary to look beyond the household level when examining resilience and adaptive capacity. Indeed, it is reasonable to assume that households are probably better able to successfully adjust to climatic shocks/change when they are part of larger coordinated efforts at the community level and beyond. The social and institutional capability dimension, in particular, is concerned with the effectiveness of informal and formal institutions in reducing risk, supporting positive adaptation, and ensuring equitable access to essential services in times of shock/stress. In the absence of this capability, we can assume that community-level duty bearers will be less effective in fulfilling their responsibilities in supporting community members in reducing risk and/or successfully adapting.

Specific characteristics believed to influence both resilience and adaptation fall under each of the five dimensions. However, no 'one size fits all'; that is, many of the characteristics appropriate for a particular population (e.g. slum dwellers in Mumbai, India) may not be so for another (e.g. Bolivian shifting cultivationists). As such, each particular suite of characteristics needs to be appropriately specified given the nature of the population in question and the hazards and change processes to which it is likely to be subjected.

[3] Ibid.

## 3.2 Particular ARR characteristics used in this Effectiveness Review

As mentioned above, there is no one generic set of 'resilience' characteristics that are applicable to all contexts. Given this, efforts were made to specify characteristics relevant to the agro-pastoral context in the project area. These characteristics are presented in Table 3.1 by dimension, along with a summary rationale for including each.

*A total of 22 relevant characteristics of resilience were identified under the five dimensions.*

Data were collected on each of the 22 characteristics identified in Table 3. 1. Eleven characteristics were defined for the livelihood viability dimension. Several of these characteristics relate to the ability of households to meet their basic needs. Those on the margins of survival are assumed to be in a worse position to cope with drought than are their more wealthy counterparts. The levels of livelihood, crop, and livestock diversification are also assumed to be important, so that the household in question has something to fall back on. A pastoral household is also assumed more likely to cope better with drought if the size of its livestock herd is both sufficiently large and healthy. Finally, having access to drought warning information and taking action on the basis of this information are additionally assumed to be important for reducing risk.

Four characteristics were defined for the innovative potential dimension. It is assumed that households are more likely to positively adapt to change if they are open to modifying their livelihood practices, aware that climate change is happening, and have good access to credit and market information.

As implied by the resilience framework presented in Subsection 3.1, there will be times when even households with viable livelihoods and internal adaptive capacity will find it difficult to cope with serious shocks. Consequently, having access to both local and external resources and support during such events is advantageous. Four characteristics are defined under the 'access to contingency resources and support' dimension. three of these relate to things directly possessed or received by the household in question: savings, remittances/formal earnings, and livestock that can be liquidated relatively easily if necessary (sheep, goats and poultry). Having strong sources of support through networks within the community is further assumed to be important. Participation in community groups is used as an indicator of this characteristic.

The availability and quality of grazing land and water sources are clearly of prime importance to a pastoralist population. However, it is particularly difficult to make objective assessments of these in a household survey. The one characteristic under the 'integrity of the natural and built environment' dimension that was included in the survey was the availability of water sources for livestock. Information on the community's recent experiences in accessing pasture land was gained through a qualitative questionnaire, which was conducted with a group of key informants in each community (normally the community elders, sometimes in the presence of the chief). These interviews confirmed that the communities supported by this project generally

**Table 3.1: Specific ARR characteristics used in the DMI Livestock Project Effectiveness Review**

| Dimension | Characteristic | Rationale for Inclusion |
|---|---|---|
| Livelihood viability | • Livelihood diversification | Households with more diverse livelihoods assumed to be at less risk |
| | • Livestock diversification | More diversity, more drought tolerant livestock = less risk |
| | • Livestock herd size | The larger the herd size, the less the impact of livestock loss |
| | • Crop diversification | More diversity, more drought tolerant crops = less risk |
| | • Livestock vaccination and deworming | Vaccination and deworming reduce risk from disease |
| | • Access to and use of curative veterinary services | More healthy livestock assumed to be more tolerant |
| | • Access to early-warning information | Enables the household to plan and reduce risk |
| | • Drought preparedness practice | Indicates that the household is proactive in minimising risk |
| | • Livestock lost to drought in 2010/11 | Direct indicator of susceptibility to impacts of drought |
| | • Household wealth status | Poor households assumed to be more at risk |
| | • Household food security | Food insecure HHs assumed to have less viable livelihoods |
| Innovation potential | • Attitudes towards new livelihood practices | Households less open to new practices are less likely to innovate |
| | • Awareness of climate change | Households with more awareness in better position to adapt |
| | • Innovation practice | Direct indicator that household is innovative |
| | • Use of livestock pricing information | Indicates willingness and initiative to use innovative approach |
| Access to contingency resources and support | • Participation in community groups | More opportunities for support in times of crises |
| | • Savings | More savings a household has, the more it can cope in crises |
| | • Remittances or formal earnings | Better access to remittances = better coping in crises |
| | • Ownership of convertible livestock (sheep, goats and poultry) | Enable the household to get by in times of crises |
| Integrity of the natural and built environment | • Availability of water for livestock | More difficulties in access makes it more difficult to cope |
| Social & institutional capability | • Participation in land-use planning meetings | Indicates planning is taking place and public participation |
| | • Received training on drought preparedness and/or livelihoods issues | Indicates that community institutions are fulfilling roles |

experienced more difficulties in securing access to grazing land than the comparison communities.

Finally, two characteristics were assessed under the Social and Institutional Capability dimension. These characteristics are intended to indicate how strong the capacity of community-level institutions is both in reducing risk and in supporting adaptation. Hence, such capacity is assumed to be high when community members report participating in land-use planning meetings and receiving training on drought prevention issues. It is important to note that the DMI Livestock project intended to affect this latter characteristic directly through the formation of the pastoralist field schools which provide training to their members. However, the direct support provided by Oxfam to the PFS groups had ended more than 12 months before the time of the survey. If the PFS groups were still in operation and still providing training during the 12 months prior to the survey, then that shows that the PFS structure was durable (at least over this time-frame), and so it is justified to consider this a positive effect on social capacity.

Following the Alkire-Foster method, binary cut-offs were defined for each of the 22 characteristics. A household was coded as being non-deprived if it can be considered as faring reasonably well in relation to the characteristic in question. The particular cut-offs used for each characteristic are presented in Appendix 2. There is inevitably a degree of arbitrariness in defining such cut-offs. However, the results presented in Section 6 also include some alternative measures, which act as checks on the robustness of the results obtained from applying the cut-offs.

Each of the individual characteristics presented in Table 3.1 was weighted equally in calculating the overall resilience measures. This means that the index is heavily weighted towards characteristics of livelihood viability and less so towards the other four dimensions.

The first measure of overall resilience used to derive the results detailed in Section 6.3 is the proportion of characteristics for which the household scored positively. Further, a household was defined as having positive resilience *overall* if it met the cut-off for positive resilience in at least two thirds of these characteristics. A resilience index was created which takes a value of 1 if the household reaches that benchmark for overall resilience and otherwise is equal to the proportion of characteristics the household scored positively on.

*Three different aggregate measures of resilience were evaluated.*

Finally, the Oxfam GB global indicator for resilience is based on whether each household is doing better in terms of overall resilience than a 'typical' household in the area. This is defined by comparing each household's resilience index with the median of the comparison group. In particular, the global indicator takes the value of 1 if the resilience index is greater than the median of the comparison group and zero otherwise.

In summary, the three key measures of overall resilience analysed in Section 6.3 are:

- The base resilience index: the proportion of characteristics for which the household reaches the cut-off for positive resilience.
- The Alkire-Foster (AF) resilience index: whether the household reaches the cut-off in at least two-thirds of the characteristics, and otherwise equal to the proportion of characteristics for which they do reach the cut-off.
- The global indicator, based on whether the AF resilience index is greater than the median of the comparison group or not.

# 4 Impact assessment design

## 4.1 Limitations in pursuing the 'gold standard'

A social programme's net effect is typically defined as the average gain participants realise in outcome (e.g. improved household food security) from their participation. In other words:

**Impact** = average post-programme outcome of participants, minus what the average post-programme outcome of these same participants would have been had they never participated

This formula seems straightforward enough. However, *directly* obtaining data on the latter part of the equation – commonly referred to as the counterfactual – is logically impossible. This is because a person, a household, or a community cannot *simultaneously* participate and not participate in a programme. The counterfactual state can therefore never be observed directly; it can only be estimated.

The randomised experiment is regarded by many as the most credible way of estimating the counterfactual, particularly when the number of units (e.g. people, households, or, in some cases, communities) that are being targeted is large. The random assignment of a sufficiently large number of such units to intervention and control groups should ensure that the statistical attributes of the two resulting groups are similar in terms of their a) pre-programmes outcomes (e.g. both groups have the same average incomes); and b) observed characteristics (e.g. education levels) and unobserved characteristics (e.g. motivation) relevant to the outcome variables of interest. In other words, randomisation works to ensure that the *potential outcomes* of both groups are the same. As a result – provided that threats such as differential attrition and intervention spill-over are minimal – any observed outcome differences observed at follow-up between the groups can be attributed to the programme.

*The Effectiveness Review attempted to ascertain what would have happened in the intervention communities had the project not been implemented.*

However, implementing an ideal impact assessment design like this is only possible if it is integrated into the programme design from the start, since it requires the introduction of some random element that influences participation. To evaluate an ongoing or completed programme – as in this Effectiveness Review – or one where randomisation was not applied, it is therefore necessary to apply alternative techniques to approximate the counterfactual as closely as possible.

## 4.2 Alternative evaluation design pursued

When the comparison group is non-equivalent there are several evaluation designs that can identify reasonably precise intervention effects – particularly when certain assumptions are made. One solution is offered by matching: Find units in an external comparison group that possess the same characteristics, e.g. ethnicity, age, and sex, relevant to the outcome variable as those of the intervention group and matching them on the bases of these characteristics. If matching is done properly in this way, the observed characteristics of the matched comparison group will be identical to those of the intervention group.

The problem, however, with conventional matching methods is that, with large numbers of characteristics on which to match, it is difficult to find comparators with similar combinations of characteristics for each of the units in the intervention group. Typically, the end result is that only a few units from the intervention and comparison groups get matched up. This not only significantly reduces the size of the sample but also limits the extent the findings can be generalised to all programme participants. (This is referred to as the ‘curse of dimensionality’ in the literature.)

Fortunately, matching on the basis of the propensity score – the conditional probability of being assigned to the programme group, given particular background variables or observable characteristics – offers a way out. Propensity-score matching (PSM) works as follows. Firstly,

units from both the intervention and comparison groups are pooled. A statistical probability model is estimated, typically through logit or probit regression. This is used to estimate programme participation probabilities for all units in the pooled sample. Intervention and comparison units are then matched within certain ranges of their conditional probability scores. Tests are further carried out to assess whether the distributions of characteristics are similar in both groups after matching. If not, the matching bandwidth or calliper is repeatedly narrowed until the observed characteristics of the groups are statistically similar. Provided that a) the dataset in question is rich and of good quality; b) the groups possess many units with common characteristics (i.e. there is a large area of common support); and c) there are no unobserved differences relevant to the outcome lurking among the groups, PSM is capable of identifying unbiased intervention effects.

Multivariable regression is another approach that is also used to control for measured differences between intervention and comparison groups. It operates differently from PSM in that it seeks to isolate the variation in the outcome variable explained by being in the intervention group *net of other explanatory variables* (key factors that explain variability in outcome) included in the model. The validity of both PSM and multivariable regression is founded heavily on the 'selection on observables' assumption, and, therefore, treatment effect estimates can be biased if unmeasured (or improperly measured) but relevant differences exist between the groups.[4] Both PSM and multivariable regression were used to analyse the data collected under this Effectiveness Review, and efforts were made to capture key explanatory variables believed to be relevant in terms of the assessed outcomes, including the sex and age of the household head, education levels, and so on.

*In an attempt to mitigate bias, two statistical procedures were used: propensity-score matching and multi-variable regression.*

In this case no baseline data were available for individual households, so efforts were made to reconstruct it during the survey through respondent recall. This method does have limitations, e.g. due to memory failure or confusion between time periods. However, for data that can reasonably be recalled, e.g. ownership of particular household assets, it can serve to enhance the validity of a cross-sectional impact evaluation design. In the case of this Effectiveness Review, the respondents were able to recall the particular baseline period – the dry season of 2007/08 – with reasonable confidence, for two reasons. Firstly, Turkana communities give names to each dry season, so enumerators were able to state the local name of the season as a prompt for the respondent's memory. Secondly, the first two months of 2008 were the occasion of widespread post-election violence throughout Kenya; most respondents were able to remember these events very clearly, and hence to describe their household's situation at the time.

The reconstructed baseline data were used in two ways: First, several of the variables included in the PSM and regression procedures were baseline variables constructed from recalled baseline data. For example, one variable was related to the respondents' wealth status at baseline, and was derived through the construction of a household

[4] One of the MVR procedures that was used attempted to control for possible unobserved differences between the groups. This is the Heckman Selection Model or 2-step Estimator. Here, efforts are made to directly control for the part of the error term associated with the participation equation that is correlated with both participation and non-participation. The effectiveness of this method, however, depends, in part, how well the drivers of participation are modelled.

wealth index based on asset ownership and other wealth indicators. This was done in an attempt to control for baseline wealth differences between the intervention and comparison groups.

The second way the reconstructed baseline data were used was to derive pseudo-difference-in-difference intervention effect estimates. With longitudinal or panel data, this is implemented by subtracting each unit's baseline measure of outcome from its end line measure of outcome (i.e. end line outcome status minus baseline outcome status). The intention here is to control for time invariant differences between the groups. Bearing in mind the limitations associated with recalled baseline data, using PSM and/or regression and the difference-in-difference approaches together is considered to be a strong quasi-experimental impact evaluation design.

## 4.3 Intervention and comparison villages surveyed

A key factor in ensuring the validity of any non-randomised impact evaluation design is to use an appropriate comparison group. This is particularly true for an ex-post, cross-sectional evaluation design. Comparators that differ in relevant baseline characteristics and/or are subjected to different external events and influences are likely to result in misleading conclusions about programme impact. Identifying a plausible comparison group is therefore critically important and is, generally speaking, not an easy task in non-experimental work.

The particular challenge in the case of the DMI Livestock project was that the interventions were intended to take effect at two different levels. Clearly the training and support provided to members of the pastoralist field schools (PFSs) and village community banks (VICOBAs) was intended to bring benefits to those members and their households. Additionally, the programme's intervention logic assumes that other community members will also indirectly benefit from the existence of these groups – mainly through the members passing on to their neighbours the content of the training which they had received. The VICOBAs are also intended to bring wider benefits through making credit available to others in the community who are not members of the group itself.

*The communities identified for comparison purposes were located close to those where the project was implemented – though of necessity they were located systematically further south.*

The challenge, then, was to identify households that could be compared with both those groups: the PFS and VICOBA members directly and the wider community members. This was addressed in two stages: Firstly, three communities were identified in the Turkana North district with populations that were thought to be generally comparable to the project communities but which had not participated in any similar project or received significant training or support from external actors in the recent past. This selection was complicated because, as highlighted in Section 2, the communities chosen for implementation of the project were targeted specifically because they were the most remote communities accessible to Oxfam. Those communities which were available for comparison were therefore all located further south, slightly closer to the main transport links. This results in a systematic difference which will have to be considered when interpreting the results in Section 6 below. In particular, the project communities, due to their increased remoteness, are thought typically to experience more security problems, such as disputes over access to grazing land with pastoralists based in Ethiopia. (This information was confirmed during the Effectiveness

Review by means of a brief qualitative questionnaire conducted with a group of key informants in each community). It was therefore anticipated from the outset of the Effectiveness Review that the comparison group would not be ideal. For this reason, the questionnaire carried out with households particularly emphasised the collection of recalled baseline data on key outcomes, so as to be able to construct difference-in-difference estimates that control for time-invariant differences between the supported and comparison communities.

Next, it was necessary to determine how to select respondents within each community. Selecting the members of PFS and VICOBA groups in the project communities was straightforward. It was clear, however, that these group members could not be compared with the general population in the comparison communities. The fact that these people chose to participate in the PFS and VICOBA groups suggests that they are likely to differ in important respects from others in these communities. In particular, they may tend to differ in terms of their motivation or willingness to participate in new initiatives or perhaps in terms of their existing social connections. These factors would be very difficult to assess in a survey, so could not be controlled when estimating outcomes; this could lead to bias in the estimates of the project's effect on these individuals.

*The survey team identified groups in the comparison communities which could be plausibly compared with the PFS and VICOBA groups in the project communities.*

Instead, the approach adopted was to identify groups in each of the comparison communities that were reasonably similar to the PFS and VICOBA groups supported by the DMI Livestock project, but which had not received significant external support. Particular emphasis was given to selecting groups for which the selection process was similar to that used for the PFS and VICOBA groups, so that the people who participate in them were likely to have similar motivations and social connections as those who joined the PFS and VICOBA groups.
The survey team therefore sought to identify women's groups, savings and loan groups, and other solidarity groups in each comparison community that had formal lists of members but which had received little or no external support in the recent past.

The DMI Livestock project intended to benefit not only the members of the PFS and VICOBA groups themselves but also the wider community. In both the intervention and comparison communities, therefore, a random sample of households who were *not* members of those groups was interviewed. In the analysis of outcomes among the general population conducted in Section 6, the group members have been weighted by their approximate proportion in the overall population in the community. This means that the outcome estimates derived reflect, as far as possible, the effects on the population of those communities as a whole.

# 5 Methods of data collection and analysis

## 5.1 Data collection

A household questionnaire was developed to capture data on various outcome measures associated with the measurements of resilience, as discussed in Section 3. Demographic data and recalled baseline data were also collected, to statistically control for differences between the supported and comparison households that could not plausibly be

affected by the project. The survey was carried out by enumerators who were native speakers of the Turkana language. The questionnaire was pre-tested first by Oxfam local staff and then by the enumerators during a practice exercise and revised accordingly.

Upon arriving in each community, the survey team first obtained a copy of the membership lists of the PFS and VICOBA groups (in the case of the project communities) or the membership lists of the groups selected for comparison in the non-project communities. A unique code was assigned to each household represented in the membership of those groups. As far as possible, the interviews were conducted with all households represented in the membership of the two groups. Following these interviews, the survey team then selected a random sample of households in the community who were not members of PFS and VICOBA groups. This was done by asking community elders to identify the various areas of each community (often referred to in English as 'villages' within the community) and disbursing the enumerators throughout these different areas.

From there, each enumerator would spin a pen, and carry out the survey in the first household they came across in the direction indicated – excluding those households that had already been surveyed as members of the PFS or VICOBA groups.

Table 5.1 shows the numbers of group members and randomly-selected non-group members in each community in the survey. A total of 509 households were interviewed, of which 208 were in project communities and the remainder in comparison communities.

**Table 5.1: Intervention and comparison communities and sample sizes**

| *Intervention communities* | | | *Comparison communities* | | |
|---|---|---|---|---|---|
| **Community name** | **PFS and VICOBA members interviewed** | **Non- members interviewed** | **Community name** | **Group members interviewed** | **Non- members interviewed** |
| Kokuro | 32 | 40 | Kakelae | 59 | 39 |
| Lokamariyang | 30 | 39 | Loruth | 57 | 42 |
| Napak | 28 | 39 | Karibor | 40 | 65 |
| **Totals** | **90** | **118** | | **155** | **146** |

## 5.2 Data analysis

Data-entry was carried out in Lodwar by a team of temporary staff. Data analysis was performed in Stata by staff from OGB's office in Oxford.

The results of this analysis are presented in Section 6. Most of the analyses involved group mean comparisons using *t*-tests, as well as PSM with the *psmatch2* module and various multivariable regression approaches. Kernel and nearest neighbour matching without replacement were used to implement PSM. Variables used in the matching process were identified by using backwards stepwise regression to identify those variables correlated with either being in an intervention village or a PFS or VICOBA group at *p*-values of 0.25 or less. Covariate balance was checked following the implementation of each matching procedure, and efforts were made to ensure that the covariates were balanced across groups at *p*-values greater than 0.25. Boot-strapped standard errors enabled the generation of confidence

intervals to enable statistical hypothesis testing. (See Appendix for further details.)

All the covariates presented in Table 6.1 were included in the various regression approaches undertaken, i.e. regression with robust standard errors (to address issues of heteroscedasticity), robust regression (to reduce the influence of outliers), and regression with control functions (to attempt to control for relevant unobserved differences between the intervention and comparison groups).

Given that all the households represented in the membership of the PFS and VICOBA groups were interviewed, but only a random sample of the general population in the communities, sampling weights were used when calculating estimates of outcomes at the community level.[5]

## 5.3 Main problems and constraints encountered

Despite the difficulties of operating in the northern part of Turkana County, the data collection process was completed successfully. However, several factors were encountered which affect the analysis process and the interpretation of results presented in Section 6:

*For practical reasons, households that were absent from the community on the day the survey team visited could not be interviewed at all.*

- **Bias in respondent sample:** Many of the members of the PFS and VICOBA groups were unavailable for interview in the community itself at the time of the survey, mostly because they were away tending livestock. Visiting grazing lands and locating these individuals was not possible, given security and resource constraints. The long distances and security considerations involved prevented enumerators from returning on subsequent days to interview those who were absent on the first day. Since the Effectiveness Review focused mostly on household-level outcomes, in some cases it was possible to interview an alternative member of the household when members of the PFS or VICOBA groups were themselves absent. However, in a significant number of cases there was no other household member available, which meant that no survey could be conducted. This has two consequences. Firstly, the number of households of group members included in the final dataset is smaller than had been expected, thereby, reducing statistical power. Second, and more importantly, given that those who were away tending animals at the time of the survey were excluded, the households of group members that were interviewed cannot be assumed to represent the membership of these groups as a whole. Therefore, the resulting data does not allow evaluation of the effects of the DMI Livestock project as a whole, but is instead focuses on the effects of the project on the types of households that were available for interviewing on the day of the survey. It is assumed that the same

[5] Defining sample weights was problematic, since reliable figures on the population of each community were not available. The figures for the number of households provided by community leaders themselves appeared to be overestimated. Instead, in the first community visited, Kokuro, the number of households was taken from the Kenyan census of 1999 (the last census for which community-level data is available) as 309. This number of households was then inflated by assuming that the growth in the number of households in Kokuro between the 1999 and 2009 census was the same as in Turkana County as a whole, at 90%. This led to an estimated number of households in the community in 2009 of 587; this same figure was assumed to apply at the time of the project's launch, i.e. when members of the PFS and VICOBA groups were selected in 2008. The number of households represented in the membership of the PFS and VICOBA groups in Kokuro was approximately 50, which is 8.5 per cent of the estimated number of households in the community. This same figure was assumed to apply in the other survey communities, and used as the weight to be applied when calculating estimates of the effect of the project at a community level. There is a great deal of uncertainty in this estimate, but it seems clear that allowing this figure to vary within reasonable bounds will not materially affect the results presented in Section 6.

limitation applies to the estimates of the effects on the general population in the supported communities.

- **Selection of community groups in comparison communities:** In general, this process was carried out satisfactorily. However, in the community of Napak, the survey team selected for comparison purposes the members of a VICOBA group which was said to have previously been supported by Oxfam. It appears that the level of support that had been provided to this group was much smaller than that applied to the VICOBA groups supported by the DMI Livestock project. However, the fact that this is not a 'pure' comparison group means that the estimates of the effects of the project derived in Section 6 may to some extent be underestimates.

- **Significant baseline and demographic differences between intervention and comparison groups:** As presented in Section 6.1 below, there are some systematic differences between the intervention and comparison groups in terms of the baseline and demographic characteristics reported in the survey. In the analysis of the outcome measures, both PSM and regression procedures were used to control for these differences to the greatest extent possible. However, in the case of the former, some of the supported households were dropped because of the absence of appropriate comparison households. In particular, 14 of the 89 households of group members were dropped using the PSM kernel model, and 10 of the 89 were dropped using the no-replacement model. In addition, 13 of the 118 randomly-selected community members were dropped using the PSM kernel model, and 18 using the no-replacement model. This means that the estimates of differences in outcome characteristics between the various treatment groups only apply those intervention households that were not dropped; that is, they do not represent the surveyed population as a whole. This problem is similar to that presented under the first bullet point above. Both issues mean that the estimates of the project's impact made in this report are based on a sample that is not representative of all the households supported by the project.

*Several significant baseline and demographic differences were found between the intervention and comparison populations.*

# 6 Results

## 6.1 General characteristics

Table 6.1 presents statistics for various household characteristics obtained through the administration of the questionnaires to the respondents from both the intervention and comparison villages. Three different comparisons were made: (a) households in intervention communities against households in comparison communities (weighted to account for the over-sampling of group members); (b) PFS and VICOBA members' households against group members' households in comparison communities; and (c) PFS and VICOBA members' households against non-members' households, in intervention communities only. The asterisks indicate differences between the groups that are statistically significant at a 90 percent confidence level or greater. As is evident, there are some significant differences between the intervention and comparison groups. In particular:

- Households in the project communities (and also the households of members of the PFS and VICOBA groups) are significantly more likely to be female-headed than households in the comparison communities. Consequently, the person responding to the survey was also more likely to be female.
- Possibly related to this first difference, women in the project communities were more likely to be a second or subsequent wife of their husband, rather than the first wife.
- Households in the project communities were also significantly larger than in the comparison communities. When group members are examined, those in the supported communities have 0.9 additional members than the comparison communities; in the overall population, the difference is about 0.5 additional household members on average.
- Household heads tended to be older in the project communities than the comparison communities, although the difference on average is only three years.
- Households in the project communities reported owning 23 cattle on average at baseline, compared to only 12 in the comparison communities. Other measured differences in the quantities of livestock owned at baseline are not statistically significant.
- Larger proportions of households in the supported communities reported having some income from providing a skilled service (such as a mechanic, mason or community animal health worker).
- Group members in the project communities were also cultivating, on average, 0.3 acres more land at baseline in 2007/08 than group members in comparison communities.
- Presumably as a consequence of the greater importance of these alternative income sources, livestock was reported to be a less important contributor to overall household income at baseline in 2007/08. Specifically, households in the project communities reported that livestock contributed 51 per cent of household income in 2007/08, compared to 55 per cent in the comparison communities. Among members of the supported PFS and VICOBA groups, this figure was 47 per cent on average.
- Group members in project communities were significantly less likely to have received humanitarian aid at baseline in 2007/08 than comparison group members.

Households in the project communities were larger, more likely to be female headed, and more engaged in livelihoods other than livestock rearing at baseline in 2007/08 than were households in comparison communities.

In addition, there are some indications of a difference in the estimated baseline wealth status between project and comparison communities: households in the supported communities (both the group members and the general population) may on average have been wealthier at baseline than households in the comparison villages.[6] These differences are not statistically significant, so they should not be treated with confidence, but it is important to note the possibility of a baseline difference, because it may affect the interpretation of some outcome measures in Section 6.2.

Given that there are significant baseline and demographic differences between the supported and comparison households, comparing the outcomes directly could result in biased estimates of the impacts of the project. It was therefore important to control for these baseline and demographic differences during the analysis of the data.

[6] The calculation of this wealth index is detailed in Section 6.2.3.

## *Table 6.1: Descriptive statistics for intervention and comparison respondents*

| | Overall sample mean | Intervention communities | Group members in intervention communities | Comparison communities | Group members in comparison communities | Intervention against comparison communities | | Group members in intervention against group members in comparison communities | | Group members against non-members in intervention communities | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Difference | t-statistic | Difference | *t*-statistic | Difference | *t*-statistic |
| Respondent is head of household | 0.493 | 0.512 | 0.556 | 0.477 | 0.587 | 0.034 | 0.60 | -0.032 | -0.48 | 0.047 | 0.67 |
| Respondent is female | 0.782 | 0.832 | 0.856 | 0.742 | 0.714 | 0.090* | 1.96 | 0.141** | 2.54 | 0.025 | 0.49 |
| Household size | 6.746 | 7.018 | 7.800 | 6.533 | 6.903 | 0.485** | 2.00 | 0.897*** | 3.12 | 0.842** | 2.55 |
| Number of adults | 2.986 | 3.145 | 3.382 | 2.861 | 3.232 | 0.284 | 1.58 | 0.150 | 0.67 | 0.255 | 1.11 |
| All adults in household are aged over 60 years | 0.012 | 0.017 | 0.011 | 0.008 | 0.019 | 0.008 | 0.67 | -0.008 | -0.48 | -0.006 | -0.34 |
| Only one adult in household | 0.089 | 0.107 | 0.067 | 0.076 | 0.077 | 0.032 | 0.94 | -0.010 | -0.29 | -0.043 | -1.05 |
| Household head is female | 0.281 | 0.346 | 0.444 | 0.228 | 0.301 | 0.118** | 2.30 | 0.144** | 2.28 | 0.105 | 1.55 |
| Most senior female in household is a first wife † | 0.668 | 0.591 | 0.667 | 0.729 | 0.632 | -0.139** | -2.58 | 0.034 | 0.54 | 0.082 | 1.20 |
| Age of household head | 45.230 | 46.919 | 44.644 | 43.901 | 46.445 | 3.018** | 2.04 | -1.801 | -0.94 | -2.449 | -1.27 |
| Household head can write | 0.088 | 0.107 | 0.178 | 0.072 | 0.110 | 0.035 | 1.07 | 0.068 | 1.51 | 0.076 | 1.59 |
| Household head has some primary education | 0.087 | 0.113 | 0.156 | 0.067 | 0.181 | 0.047 | 1.45 | -0.025 | -0.29 | 0.045 | 0.96 |
| Number of adults with some primary education | 0.460 | 0.530 | 0.584 | 0.406 | 0.677 | 0.124 | 1.23 | -0.093 | -0.62 | 0.059 | 0.49 |
| Household head has some secondary education | 0.029 | 0.043 | 0.044 | 0.019 | 0.065 | 0.024 | 1.18 | -0.020 | -0.26 | 0.002 | 0.07 |
| Number of adults with some secondary education | 0.118 | 0.126 | 0.112 | 0.111 | 0.194 | 0.015 | 0.22 | -0.081 | -0.89 | -0.015 | -0.28 |
| Household head engages in productive activity | 0.882 | 0.856 | 0.867 | 0.902 | 0.825 | -0.047 | -1.25 | 0.042 | 0.86 | 0.012 | 0.24 |
| Number of productive adults | 2.665 | 2.786 | 3.135 | 2.570 | 2.766 | 0.216 | 1.29 | 0.369* | 1.70 | 0.376 | 1.65 |
| Productive activities of the household in 2007/08: | | | | | | | | | | | |
| Rearing livestock | 0.970 | 0.957 | 0.956 | 0.980 | 0.981 | -0.022 | -1.08 | -0.025 | -1.13 | -0.002 | -0.07 |
| Selling livestock products | 0.657 | 0.667 | 0.744 | 0.649 | 0.697 | 0.018 | 0.33 | 0.048 | 0.79 | 0.083 | 1.30 |
| Agriculture | 0.206 | 0.232 | 0.267 | 0.185 | 0.316 | 0.046 | 1.01 | -0.049 | -0.81 | 0.038 | 0.63 |
| Fishing | 0.015 | 0.025 | 0.022 | 0.007 | 0.013 | 0.018 | 1.19 | 0.009 | 0.55 | -0.003 | -0.15 |
| Non-agricultural income-generating activity | 0.744 | 0.787 | 0.878 | 0.710 | 0.813 | 0.077 | 1.55 | 0.065 | 1.32 | 0.098* | 1.84 |
| Service business (e.g. mason, mechanic, CAHW) | 0.060 | 0.087 | 0.233 | 0.038 | 0.077 | 0.049* | 1.83 | 0.156*** | 3.52 | 0.157*** | 3.26 |
| Casual labour | 0.268 | 0.269 | 0.344 | 0.267 | 0.265 | 0.002 | 0.03 | 0.080 | 1.32 | 0.082 | 1.28 |
| Formal employment | 0.046 | 0.057 | 0.033 | 0.038 | 0.071 | 0.020 | 0.80 | -0.038 | -1.22 | -0.026 | -0.87 |
| Household received remittances in 2007/08 | 0.150 | 0.176 | 0.156 | 0.129 | 0.123 | 0.047 | 1.13 | 0.033 | 0.73 | -0.022 | -0.43 |
| Household received humanitarian aid in 2007/08 | 0.639 | 0.625 | 0.644 | 0.649 | 0.787 | -0.024 | -0.43 | -0.143** | -2.46 | 0.021 | 0.30 |
| Household head is of Turkana ethnicity | 0.988 | 0.990 | 0.967 | 0.986 | 0.981 | 0.004 | 0.34 | -0.014 | -0.68 | -0.025 | -1.29 |
| Household head is Roman Catholic | 0.787 | 0.824 | 0.744 | 0.758 | 0.735 | 0.067 | 1.46 | 0.009 | 0.15 | -0.086 | -1.52 |
| Household head is Christian | 0.880 | 0.893 | 0.933 | 0.871 | 0.877 | 0.022 | 0.60 | 0.056 | 1.39 | 0.044 | 1.08 |
| Proportion of income from livestock in 2007/08 | 0.533 | 0.506 | 0.478 | 0.555 | 0.558 | -0.050* | -1.83 | -0.080*** | -2.72 | -0.030 | -0.89 |
| Livestock holdings in 2007/08: | | | | | | | | | | | |
| Cattle | 16.824 | 23.165 | 18.678 | 11.837 | 15.839 | 11.328** | 2.06 | 2.839 | 0.70 | -4.831 | -0.69 |
| Shoats | 93.995 | 87.227 | 108.022 | 99.317 | 90.910 | -12.090 | -0.91 | 17.113 | 1.20 | 22.387 | 1.36 |
| Camels | 2.292 | 1.688 | 2.711 | 2.767 | 1.994 | -1.079 | -1.25 | 0.718 | 0.62 | 1.101 | 0.91 |
| Donkeys | 3.109 | 3.194 | 3.622 | 3.042 | 3.310 | 0.152 | 0.31 | 0.313 | 0.46 | 0.461 | 0.83 |
| Wealth index 2007/08 | -0.079 | 0.065 | 0.348 | -0.191 | -0.040 | 0.256 | 0.86 | 0.388 | 1.40 | 0.305 | 0.84 |
| Poorest third in 2007/08 | 0.358 | 0.341 | 0.256 | 0.372 | 0.329 | -0.031 | -0.57 | -0.073 | -1.21 | -0.092 | -1.42 |
| Middle third in 2007/08 | 0.380 | 0.397 | 0.267 | 0.367 | 0.277 | 0.030 | 0.53 | -0.011 | -0.18 | -0.140** | -2.12 |
| Wealthiest third in 2007/08 | 0.261 | 0.262 | 0.478 | 0.261 | 0.394 | 0.002 | 0.03 | 0.084 | 1.28 | 0.232*** | 3.57 |
| Number of acres cultivated in 2007/08 | 0.723 | 1.493 | 0.517 | 0.117 | 0.225 | 1.376 | 1.16 | 0.292** | 2.06 | -1.051 | -0.72 |
| Number of crops grown in 2007/08 | 0.717 | 0.775 | 1.044 | 0.671 | 1.181 | 0.104 | 0.52 | -0.136 | -0.47 | 0.290 | 1.05 |
| **Observations** | **509** | **208** | **90** | **301** | **155** | **509** | | **245** | | **208** | |

* $p<0.1$, ** $p<0.05$, *** $p<0.01$; sample weights have been applied in the data relating to overall populations of communities.

† Where the senior female in the household is widowed or divorced, or where there was no married female in the household, the household was coded with a zero for this variable.

Households of PFS and VICOBA members were on average wealthier in 2007/08 than their neighbours in the same communities.

The final two columns of Table 6.1 compare the baseline and demographic characteristics between the PFS and VICOBA group members and the randomly-sampled households in the project communities only. This information is of interest in understanding what types of people within the community were recruited into the PFS and VICOBA groups. In particular:

- Group members appear to have been considerably more wealthy at baseline in 2007/08 than the general population. Approximately 48 per cent of the group members' households were calculated as being in the top third by wealth measures in 2007/08, compared to only 26 per cent of households overall in those sample communities.
- Households of group members were particularly likely to have been engaged in some service business and in other non-agricultural income-generating activities at baseline in 2007/08.
- Group members also had significantly larger households than non-group members in their communities.

## 6.2 Differences between the intervention and comparison households on the outcome measures

### *6.2.1 Overall resilience indices*

As discussed in Section 3.2, the measures of households' overall ability to reduce risk and adapt to climate trends analysed in this Effectiveness Review are based on the characteristics of resilience listed in Table 3.1. Cut-offs were defined for each characteristic. Those above the cut-offs are assumed to be non-deprived in relation to the charactersitcs and deprived if otherwise. The cut-offs used in this analysis are presented in Appendix 2.

Only three per cent of the surveyed households were found to have met this overall benchmark for positive resilience. However, there is considerable variation among the households in the number of

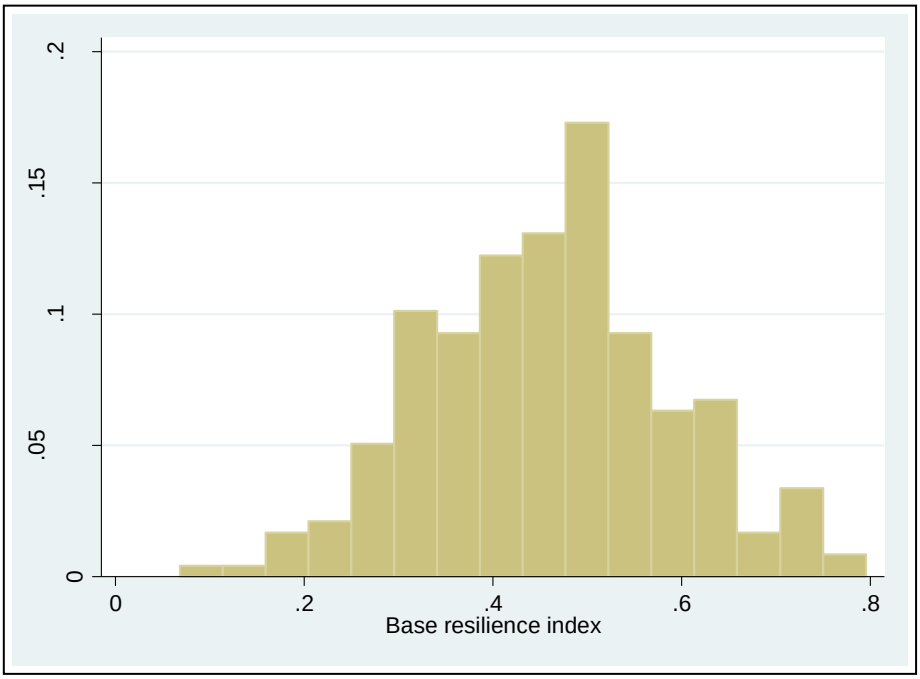



**Figure 6.1: Histogram of base resilience index for group members**

characteristics in which they met the cut-offs. Figure 6.1 is a histogram representing the proportion of characteristics group members from both the supported and comparison communities scored positively on. This index is referred to as the *base resilience index* in this report. It can be seen that no household scored positively on more than 80 per cent of the characteristics, but that the majority of households scored positively on between 30 per cent and 55 per cent of the characteristics.

Group members in the project communities scored positively on significantly more of the characteristics of resilience than those in comparison communities.

Table 6.2 shows the differences between the members of the Oxfam-supported PFS and VICOBA groups in the intervention communities, as well as members of non-supported groups in the comparison communities, in terms of three different resilience measures. The upper section of the table shows the raw unadjusted differences in the values. Here, the surveyed group members are, on average, scored positively on 46 per cent of characteristics, while the supported group members scored positively on 49 per cent of characteristics, and the comparison group members in 44 per cent of characteristics. The second section presents results of analyses that compared the intervention and supported households using two different forms of propensity-score matching (PSM), while the third section does the same for three different regression models. As column 1 shows, all five statistical models concur that the supported group members were resilient in a higher proportion of the characteristics than were the

**Table 6.2: Indices of resilience – comparison of intervention and comparison group members**

| | (1) **Base resilience index** | (2) **AF resilience index** | (3) **Global indicator (AF resilience index above median of comparison group)** |
|---|---|---|---|
| *Unadjusted:* | | | |
| Sample mean | 0.458 | 0.475 | 0.586 |
| Intervention mean: | 0.491 | 0.523 | 0.659 |
| Comparison mean: | 0.440 | 0.448 | 0.546 |
| Unadjusted difference : | 0.051*** | 0.075*** | 0.113* |
| | (2.96) | (3.29) | (1.69) |
| Observations: | 237 | 237 | 237 |
| *PSM (ATT)* | | | |
| Post-matching difference: | 0.086*** | 0.114*** | 0.231** |
| (kernel) | (3.70) | (3.69) | (2.54) |
| Observations: | 220 | 220 | 220 |
| Post-matching difference: | 0.065*** | 0.094*** | 0.149* |
| (no replacement) | (2.85) | (3.05) | (1.77) |
| Observations: | 223 | 223 | 223 |
| *Multivariable Regression:* | | | |
| MVR coefficient : | 0.064*** | 0.090*** | 0.204** |
| (robust standard errors ) | (3.57) | (3.56) | (2.39) |
| Observations: | 233 | 233 | 225 |
| MVR coefficient | 0.060*** | 0.051*** | |
| (robust reg.) | (3.18) | (2.74) | n/a |
| Observations: | 233 | 233 | |
| MVR coefficient : | 0.064*** | 0.092*** | 0.200** |
| (with control functions) | (3.43) | (3.51) | (2.26) |
| Observations: | 233 | 233 | 225 |

*t* statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
PSM estimates bootstrapped 1000 repetitions
Coefficients for covariates used are not presented.

comparison group members. Here, the estimates of this difference range from six to nine percentage points.

The next step in the Alkire-Foster method is to define an overall binary cut-off for the entire weighted index. Households above this cut-off are considered to demonstrate positive overall resilience, because they are only deprived on a relatively small proportion of the weighted indicators. In this case, a household is defined as demonstrating positive overall resilience if it reached these cut-offs in more than two thirds of the characteristics, i.e. 15 or more of the 22 characteristics. The *Alkire-Foster (AF) resilience index* is defined to take the value of 1 (the maximum) if the household was found to be resilient in more than two-thirds of the characteristics, and takes the value of the base resilience index otherwise.

The differences between the supported and comparison group members in terms of the AF resilience index is shown in column 2 of Table 6.2. Since the majority of the few households who reached this overall benchmark of positive resilience are members of the supported PFS and VICOBA groups, using this measure has the effect of increasing the difference between supported and comparison group members, as compared with the base resilience index.

The positive difference between group members in project and comparison communities also applies to the Oxfam GB global indicator for adaptation and risk reduction.

Finally, column 3 of Table 6.2 presents the difference between supported and comparison households using Oxfam GB's global indicator for adaptation and risk reduction. To calculate this indicator, the median value of the comparison group is taken as a benchmark.[7] Households score positively on the global indicator if they have an AF resilience index score greater than the median of the comparison group, and zero otherwise. In this way, the global indicator reflects whether a household is resilient in more characteristics than a 'typical' household, as represented by the median of the comparison group. Again, it is clear that supported households score significantly better on this measure than do comparison households. Specifically, as shown by the unadjusted data (in the top section of the table), 66 per cent of the supported households are above the benchmark, against 55 per cent of the comparison households. Once baseline and demographic differences are controlled for, the estimates of the difference between the supported and comparison households range between 15 and 23 percentage points.

Given the non-experimental nature of the data, and the baseline and demographic differences between the intervention and comparison groups discussed in Section 6.1, it is important to consider how robust the finding of a positive effect on resilience is. One way of testing this is to explore how sensitive the effect estimates are to unobserved differences between the project and comparison communities. That is, how much unobserved bias would be needed to 'explain away' the effect?

To investigate this, Rosenbaum sensitivity analysis was implemented with Stata's *rbounds* command. Here, unobserved

[7] This median value is that for the survey population as a whole, not just those who were deliberately sampled as members of community groups, with sample weights applied.

bias is assumed to exist in favour of the intervention and comparison group at different log odds ratios. How large can the odds ratio be in order to render the effect estimate in question non-significant? Table 6.3 presents the results that were obtained from undertaking such analysis with the nearest neighbour one-to-one matching effect estimate on the base resilience index (column 1 in Table 6.2). The table reveals that the unobserved bias would need to be present at a log odds ratio of 2.1 in favour of the intervention population in order for the effect estimate to be rendered not statistically significant at the 5 per cent level, or a log odds ratio of 2.4 at the 10 per cent level. Qualitatively, this means that the effect estimate is significantly robust to the possible existence of omitted variable bias.

**Table 6.3: Results of Rosenbaum sensitivity analysis, where unobserved, positive bias is assumed to exist at various odds ratios among the intervention population**

| Log odds ratio of hidden bias | *p*-value of effect estimate with bias | Estimated effect with bias | 95% confidence level – two tailed | |
|---|---|---|---|---|
| | | | CI+ | CI− |
| 1 | 0.000024 | 0.080466 | 0.043404 | 0.120534 |
| 1.1 | 0.000098 | 0.073542 | 0.036935 | 0.128498 |
| 1.2 | 0.000317 | 0.068392 | 0.031548 | 0.135102 |
| 1.3 | 0.000845 | 0.061381 | 0.025575 | 0.141186 |
| 1.4 | 0.001938 | 0.056665 | 0.021454 | 0.146179 |
| 1.5 | 0.003938 | 0.052672 | 0.016885 | 0.150719 |
| 1.6 | 0.007257 | 0.04863 | 0.011848 | 0.154128 |
| 1.7 | 0.012335 | 0.044722 | 0.006193 | 0.159914 |
| 1.8 | 0.019607 | 0.040177 | 0.001881 | 0.16446 |
| 1.9 | 0.029454 | 0.037359 | -0.00098 | 0.169462 |
| 2 | 0.042175 | 0.034939 | -0.00447 | 0.174246 |
| 2.1 | 0.057964 | 0.031735 | -0.00861 | 0.177081 |
| 2.2 | 0.076899 | 0.029556 | -0.01189 | 0.181821 |
| 2.3 | 0.098944 | 0.02578 | -0.01597 | 0.185114 |
| 2.4 | 0.123955 | 0.023606 | -0.01844 | 0.188475 |
| 2.5 | 0.151698 | 0.021641 | -0.02066 | 0.192301 |

These results are moderately robust to the potential presence of unobserved variable bias.

Another important question is how robust the resilience index is to the choice of two thirds (15 characteristics) as the cut-off for positive overall resilience. Figure 6.2 shows how the value of the resilience index for the supported group members and comparison group members varies according to the cut-off applied. In this chart, the solid lines represent the mean resilience index value for the supported households (in red) and the comparison households (in green). Clearly, the mean resilience score of the supported households is equal to or higher than the mean resilience score of the comparison households at all cut-off values. The dashed lines represent the corresponding 95 per cent confidence intervals: for regions of the graph where the confidence intervals overlap, it cannot be claimed with a high degree of confidence that there is a real difference between the intervention and comparison households.

For the cut-off of two thirds (15 of the 22 characteristics) it is clear that there is a significant difference between supported and comparison households. However, reducing the cut-off to 14 or fewer characteristics would lead to overlap in the confidence intervals, and so there would be less confidence that this represents a positive result.

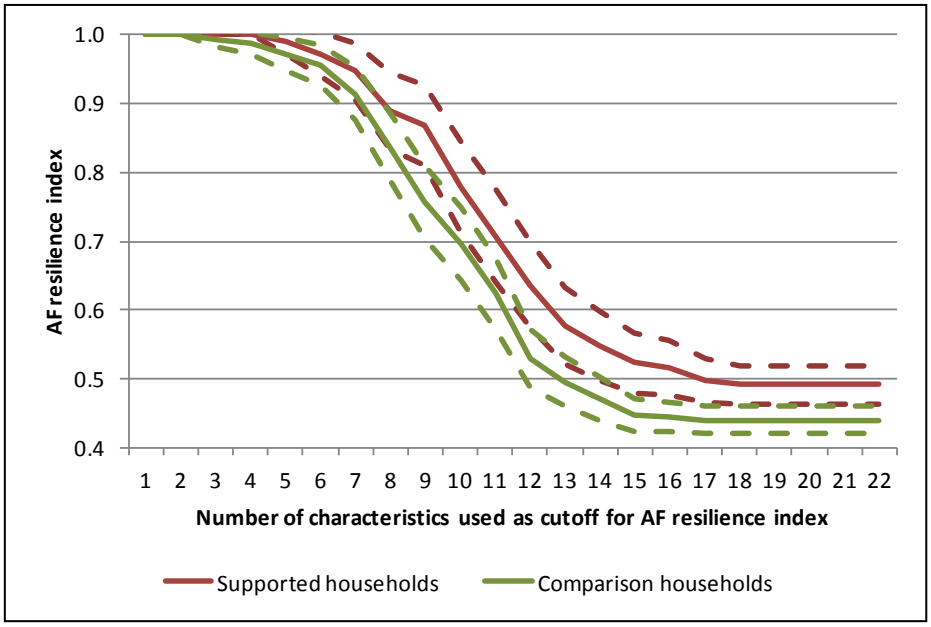



**Figure 6.2: Variation of resilience index with choice of cut-off among supported and comparison group members**

**Table 6.4: Indices of resilience – comparison of intervention and comparison households in the general population**

| | (1) **Base resilience index** | (2) **AF resilience index** | (3) **Global indicator (AF resilience index above median of comparison group)** |
|---|---|---|---|
| *Unadjusted:* | | | |
| Sample mean | 0.407 | 0.414 | 0.430 |
| Intervention mean: | 0.415 | 0.430 | 0.475 |
| Comparison mean: | 0.400 | 0.402 | 0.394 |
| Unadjusted difference : | 0.016 | 0.028 | 0.081 |
| | (1.01) | (1.51) | (1.43) |
| **Observations:** | 497 | 497 | 497 |
| *PSM (ATT)* | | | |
| Post-matching difference: | 0.012 | 0.016 | 0.052 |
| (kernel) | 1.11 | 1.18 | 1.33 |
| **Observations:** | 467 | 467 | 467 |
| Post-matching difference: | 0.010 | 0.003 | 0.001 |
| (no replacement) | 0.68 | 0.14 | 0.02 |
| **Observations:** | 465 | 465 | 465 |
| *Multivariable Regression:* | | | |
| MVR coefficient : | 0.016 | 0.030* | 0.111 |
| (robust standard errors ) | (1.07) | (1.75) | (1.59) |
| **Observations:** | 486 | 486 | 479 |
| MVR coefficient : | 0.015 | 0.029* | 0.114 |
| (with control functions) | (0.96) | (1.67) | (1.59) |
| **Observations:** | 485 | 485 | 478 |

*t* statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
PSM estimates bootstrapped 1000 repetitions
Coefficients for covariates used are not presented.
Sample weights have been applied.

Table 6.4 presents the same indicators as in Table 6.2, but this time with the differences considered between the overall population in the project communities, compared to the overall population in the comparison communities. On each of the three measures, the

estimated level of resilience is generally higher among the supported communities than among the comparison communities. However, these differences are small and none of them are statistically significant, which means that it cannot be claimed with any confidence that the resilience levels are higher in the general population.

Among the general population, there are no significant overall differences in indices of resilience between the project and comparison communities.

It should also be remembered that the members of the PFS and VICOBA groups for which the results were analysed in Table 6.2 are included in the overall community populations analysed in Table 6.4.[8] From comparing the top sections of the two tables, it can be seen that the levels of resilience are, on average, higher among group members than among non-members, both in the intervention and the comparison communities. For example, 59 per cent of the group members across the intervention and comparison communities scored positively the global indicator, but only 43 per cent of the general population did so. The fact that this pattern is clear within the comparison communities, as well as the project communities, suggests – as would be expected – that membership of a community group is associated with greater resilience, even before the effect of this project is considered.

Again, Figure 6.3 shows the robustness of the results on the resilience index to the choice of cut-off. It can be seen that the confidence intervals for the supported and comparison households overlap for any choice of cut-off. This further reinforces the finding that there is no evidence of overall higher resilience in the supported communities than in the comparison communities, whatever value is chosen for the cut-off.

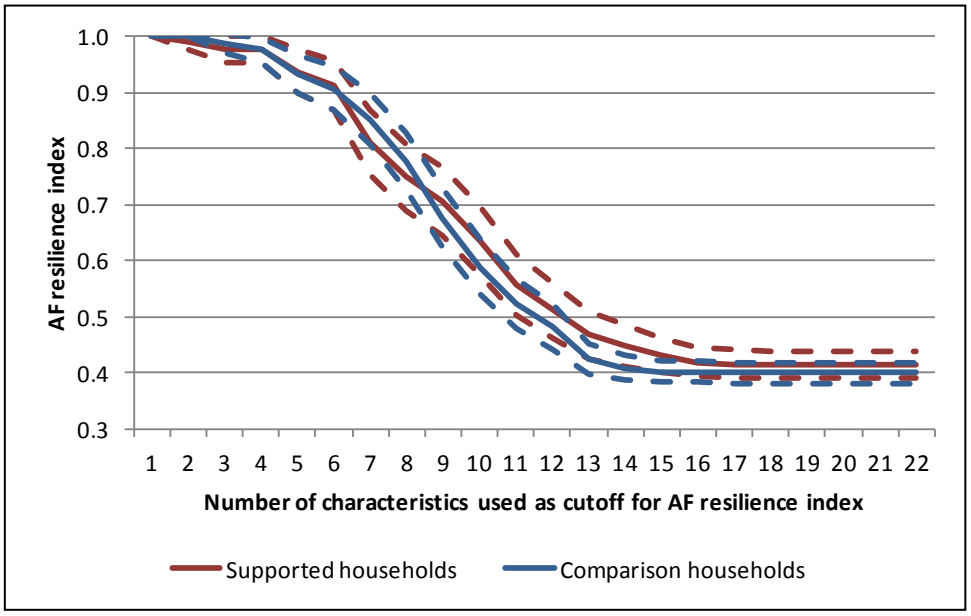



**Figure 6.3: Variation of resilience index with choice of cut-off among the general population in supported and comparison communities**

[8] As described in Section 5.2, the group members have been weighted by the approximate proportion in the overall population, so that the results in Table 6.2.3.2 and subsequent tables reflect as closely as possible the actual balance of the population.

### *6.2.2 Dimension 1: Livelihood viability*

The index of livelihood viability is significantly higher in the project communities – among both group members and the general population.

As per the resilience measurement framework presented in Section 3, the first dimension examined pertains to livelihood viability. To what extent is there evidence that households in the intervention villages possess livelihoods that are more resilient to shocks than the comparison households? In other words, to what extent are they better off in relation to the characteristics assessed under the livelihood viability dimension?

To answer this question, an index specific to the livelihood viability dimension was created. This livelihood viability index is derived from the 11 characteristics considered as part of this dimension, as described in Table 3.2. The index simply represents the percentage of these 11 characteristics for which the household scores positively. Table 6.5 presents the results of a comparison of the treatment groups in relation to this index.

**Table 6.5: Index of livelihood viability – comparison of intervention and comparison households**

| | (1) **Group members** | (2) **General population** |
|---|---|---|
| *Unadjusted:* | | |
| Sample mean: | 0.433 | 0.408 |
| Intervention mean: | 0.469 | 0.437 |
| Comparison mean: | 0.412 | 0.385 |
| Unadjusted difference : | 0.057*** | 0.051*** |
| | (2.87) | (2.99) |
| **Observations:** | 240 | 502 |
| *PSM (ATT)* | | |
| Post-matching difference: | 0.092*** | 0.059*** |
| (kernel) | (3.18) | (4.84) |
| **Observations:** | 223 | 472 |
| Post-matching difference: | 0.061** | 0.044** |
| (no replacement) | (2.35) | (2.76) |
| **Observations:** | 226 | 470 |
| *Multivariable Regression:* | | |
| MVR coefficient : | 0.074*** | 0.060*** |
| (robust standard errors ) | (3.30) | (3.54) |
| **Observations:** | 236 | 491 |
| MVR coefficient | 0.075*** | |
| (robust reg.) | (3.21) | n/a |
| **Observations:** | 236 | |
| MVR coefficient : | 0.074*** | 0.060*** |
| (with control functions) | (3.14) | (3.39) |
| **Observations:** | 236 | 490 |

*t* statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
PSM estimates bootstrapped 1000 repetitions.
Coefficients for covariates used not presented.

Table 6.5 shows that surveyed households scored positively, on average, in 41 per cent of the characteristics of livelihood viability, with this proportion being slightly higher (43 per cent) among the group members. Households in the communities where the project was implemented were more likely to score positively than those in the comparison communities, even among the general population. The difference in the proportion scoring positively is variously estimated at between six and nine percentage points among the group members, and between four and six percentage points

among the general population.

It is of course essential to understand which of the underlying characteristics are contributing to these overall differences between the intervention and comparison groups. Table 6.6 shows the difference between the intervention and comparison groups in terms of each of the specific characteristics included in the livelihood viability dimension.

Households of PFS and VICOBA members increased the diversification of their livelihoods activities at a greater rate since 2007/08 than did corresponding comparison households.

Column 1 of Table 6.6 shows that the proportion of households of group members that score positively on livelihood diversification is slightly higher in the supported communities than in the comparison communities. When examining the underlying data (not shown here) on the *number* of livelihoods activities that each household engages in, there is a much clearer difference: the supported households engage (on average) in at least 0.5 more livelihoods activities than comparison households do. That result holds even if a difference-in-difference estimator is used to control for the number of livelihoods activities at baseline, which suggests that this may be due to the activities of the DMI Livestock project. A complementary measure (again, results are not shown here in detail) was that respondents were asked to estimate the proportion of their household income deriving from livestock. While interviewed group members have generally experienced a reduction in the proportion of their household income coming from livestock activities since 2008, this reduction has been less in the case of the members of the PFS and VICOBA groups supported by Oxfam than in the comparison groups. Even though the supported group members appear to have diversified their livelihood activities, they also appear to have experienced less of a decline in their income from livestock.

On the other hand, as shown in the lower panel of Table 6.6, when the populations of the project and comparison communities are considered as a whole, there is no evidence of a difference between the two in terms of livelihood diversification.

Column 2 of Table 6.6 shows that considerably higher numbers of households in the project communities scored positively in terms of livestock diversification than did those in the comparison communities. In fact the diversity of animals owned by households was generally reported to have decreased since 2008, but this decrease was smaller among households in the project communities.

The *number* of animals owned by the average household in the survey was also reported to be much smaller in 2012 than in 2008. As shown in column 3, members of the supported PFS and VICOBA groups appear to have been slightly better off than comparison households in terms of herd size at the time of the survey. However, when examining the *change* in the numbers of animals owned since 2008 (i.e. using the difference-in-difference measure), it is less clear whether there has been a positive effect. In any case, there is no evidence of a difference between the project and comparison communities as a whole in terms of those scoring positively on herd size.

Approximately a quarter of the households surveyed reported having grown some crops during the year prior to the survey. This proportion was approximately the same among in the project and comparison communities, and there is no evidence of a difference between them in terms of the diversity of crops grown.

The vast majority of households (83 per cent overall) scored positively on access to vaccination and deworming for livestock. As expected, there are no differences between the project and comparison in this regard: Oxfam's vaccination and deworming programmes in the area have covered the comparison communities as well as those supported under the DMI Livestock project.

On the other hand, more of the households in the project communities reported having good access to veterinary care than did those in the comparison communities. This difference is largely due to better access to community animal health workers (CAHWs) in the project communities, and may reflect that 155 CAHWs were trained under the DMI Livestock project. The disaggregated data show a difference of between nine to ten percentage points between the project communities and the comparison communities in the use of a CAHW, with the difference particularly marked among the PFS and VICOBA group members. As would be expected, there is no apparent difference between the project and comparison communities in terms of use of veterinary extension workers. Eighty per cent of households reported having received support from a veterinary extension worker during the 12 months prior to the survey – though it is perhaps interesting to note that only 27 per cent of these said that this support was always available when required, compared to 61 per cent of those who used a CAHW.

Access to community animal-health workers appeared to be better in the project communities than in comparison communities.

The survey also asked about respondents' access to early warning or seasonal forecasting information, both from personal contact with extension workers and from the radio. Three-quarters of respondents reported having received early-warning or seasonal-forecasting information in person, and around 70 per cent from the radio – but they also reported some problems in the timeliness of this information, which is why (as shown in column 7 of Table 6.6) only around 40 per cent scored positively on resilience in terms of this indicator. There are no indications that supported households were better off than comparison households in terms of their access to this information.

The fact that the dry season of 2010/11 was particularly severe in the project area, and that the project activities had been in place for approximately two years by that time, allows an assessment to be made of whether the project enabled supported communities to better withstand that experience. To that end, respondents were asked what actions they took to reduce the risks of losses during that dry season, as well as how many livestock they lost in the event (including animals which died and those which were weakened and had to be sold at a low price).

Column 8 of Table 6.6 shows a very clear difference between the project and comparison communities in terms of the proportions of households that took adequate drought prevention actions in

advance of the 2010/11 dry season. In particular, households in the project communities reported destocking cattle and investing in drought-resistent livestock at approximately twice the rate of households in comparison communities. There are also substantial differences in the numbers who reported storing animal feed ahead of time, requesting assistance from relatives elsewhere, and sending family members to an urban area to seek work. These differences are clear both among the PFS and VICOBA group members and among the population in general.[9] However, despite them having taken these steps to prepare for drought, households in the project communities appear to have lost on average *more* livestock due to drought in that year than did households in comparision communities. It seems unlikely that the project should have had a negative effect on households' ability to cope with drought. Instead, it appears that the 2010/11 dry season affected the supported communities more severely than the comparison communities. It is possible that the grazing lands used by the project communities are located in generally more exposed locations – which probably also means that households in these communities routinely take a wider range of drought preparedness actions than do those in the comparison communities. Unfortunately this implies that no conclusions can be drawn about the success of the DMI Livestock project from the results on drought preparedness actions or on the losses that year.

No clear conclusions cannot be drawn from data on households' response to the drought of 2010/11.

The remaining two characteristics of livelihood viability are indicators of a household's overall income and hence wellbeing: a wealth index and its experience of food insecurity. As shown in column 10 of Table 6.6, there is no clear difference between households in the project and comparison communities in terms of food security. The index of household wealth (for which the results are shown in column 11) is also higher among participant households. While this difference in the wealth index is observable in the results for the general population, further analysis shows that most of the difference is occurs among the group members.

It is therefore possible that this also represents an effect of the project actvities: perhaps the apparent diversification into alternative livelihoods activities among the PFS and VICOBA group members has led to an improvement in wealth indicators.

Further analysis of the results for food security and the wealth index is included in Appendix 3.

[9] If the difference between the intervention and comparison communities in drought preparedness activities were a result of the project, the difference would be expected to be concentrated among the supported group members, who have directly received training in this area. In fact that is not the case: statistical interaction tests show that the difference applies across the whole population, and is not particularly strong among the group members. This casts doubt on whether the difference is a result of the project activities, or whether it is due to systematic differences between the project and comparison communities.

## Table 6.6: Characteristics of livelihood viability – comparison of intervention and comparison households

| | (1) Livelihood diversification | (2) Herd diversification | (3) Herd size | (4) Crop diversification | (5) Access to vaccination and deworming | (6) Access to veterinary care | (7) Access to early-warning information | (8) Drought prevention actions taken in 2010 | (9) Livestock lost in dry season of 2010/11 | (10) Food security | (11) Wealth index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Households of group members** | | | | | | | | | | | |
| *Unadjusted:* | | | | | | | | | | | |
| Sample mean | 0.463 | 0.620 | 0.389 | 0.335 | 0.771 | 0.486 | 0.420 | 0.649 | 0.306 | 0.065 | 0.273 |
| Intervention mean: | 0.539 | 0.778 | 0.427 | 0.356 | 0.733 | 0.478 | 0.400 | 0.773 | 0.233 | 0.089 | 0.378 |
| Comparison mean: | 0.419 | 0.529 | 0.368 | 0.323 | 0.794 | 0.490 | 0.432 | 0.578 | 0.348 | 0.052 | 0.213 |
| Unadjusted difference : | 0.120* | 0.249*** | 0.059 | 0.033 | -0.060 | -0.013 | -0.032 | 0.195*** | -0.115* | 0.037 | 0.165*** |
| | (1.81) | (3.98) | (0.91) | (0.53) | (-1.08) | (-0.19) | (-0.49) | (3.10) | (-1.89) | (1.14) | (2.82) |
| **Observations:** | 244 | 245 | 244 | 245 | 245 | 245 | 245 | 242 | 245 | 245 | 245 |
| *PSM (ATT)* | | | | | | | | | | | |
| Post-matching difference: | 0.075 | 0.392*** | 0.155* | 0.005 | -0.010 | 0.121 | 0.066 | 0.167** | -0.113 | 0.047 | 0.141* |
| (kernel) | (0.82) | (4.43) | (1.94) | (0.05) | (-0.13) | (1.37) | (0.76) | (2.09) | (-1.40) | (1.26) | (1.83) |
| **Observations:** | 226 | 227 | 226 | 227 | 227 | 227 | 227 | 225 | 227 | 227 | 227 |
| **Households among general population** | | | | | | | | | | | |
| *Unadjusted:* | | | | | | | | | | | |
| Sample mean | 0.396 | 0.632 | 0.383 | 0.250 | 0.827 | 0.485 | 0.362 | 0.601 | 0.307 | 0.085 | 0.172 |
| Intervention mean: | 0.432 | 0.748 | 0.345 | 0.261 | 0.798 | 0.506 | 0.398 | 0.700 | 0.316 | 0.093 | 0.216 |
| Comparison mean: | 0.368 | 0.540 | 0.413 | 0.242 | 0.850 | 0.468 | 0.333 | 0.523 | 0.300 | 0.079 | 0.138 |
| Unadjusted difference : | 0.063 | 0.208*** | -0.068 | 0.020 | -0.052 | 0.038 | 0.066 | 0.177*** | 0.016 | 0.014 | 0.078* |
| | (1.13) | (3.92) | (-1.23) | (0.40) | (-1.19) | (0.67) | (1.20) | (3.24) | (0.30) | (0.42) | (1.81) |
| **Observations:** | 508 | 509 | 508 | 509 | 508 | 509 | 509 | 505 | 509 | 509 | 509 |
| *PSM (ATT)* | | | | | | | | | | | |
| Post-matching difference: | 0.009 | 0.356*** | 0.011 | -0.017 | -0.070** | 0.113*** | 0.017 | 0.170*** | -0.019 | -0.004 | 0.069** |
| (kernel) | (0.22) | (9.83) | (0.31) | (-0.48) | (-2.28) | (2.89) | (0.45) | (4.66) | (-0.51) | (-0.18) | (2.17) |
| **Observations:** | 477 | 478 | 477 | 478 | 477 | 478 | 478 | 475 | 478 | 478 | 478 |

*t* statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
PSM estimates bootstrapped 1000 repetitions.
Coefficients for covariates used not presented.
Sampling weights have been applied for results among the general population.

### *6.2.4 Dimension 2: Innovation potential*

Compared to the livelihood viability dimension, fewer characteristics were examined in this Effectiveness Review for the other four dimensions of resilience. In particular, four characteristics were collected relating to livelihood innovation potential. Table 6.7 shows how the index constructed from these four characteristics varies between the project and comparison communities.

**Table 6.7: Index of innovation potential – comparison of intervention and comparison households**

| | (1) **Group members** | (2) **General population** |
|---|---|---|
| *Unadjusted:* | | |
| Sample mean: | 0.421 | 0.401 |
| Intervention mean: | 0.438 | 0.399 |
| Comparison mean: | 0.412 | 0.402 |
| Unadjusted difference : | 0.026 | -0.003 |
| | (0.72) | (-0.09) |
| **Observations:** | 242 | 506 |
| *PSM (ATT)* | | |
| Post-matching difference: | 0.032 | -0.011 |
| (kernel) | (0.65) | (-0.51) |
| **Observations:** | 224 | 475 |
| Post-matching difference: | 0.058 | -0.020 |
| (no replacement) | (1.32) | (-0.72) |
| **Observations:** | 228 | 474 |
| *Multivariable Regression:* | | |
| MVR coefficient : | 0.032 | -0.017 |
| (robust standard errors ) | (0.79) | (-0.50) |
| **Observations:** | 238 | 495 |
| MVR coefficient | 0.062 | |
| (robust reg.) | (1.35) | n/a |
| **Observations:** | 238 | |
| MVR coefficient : | 0.034 | -0.020 |
| (with control functions) | (0.82) | (-0.58) |
| **Observations:** | 238 | 494 |

*t* statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
PSM estimates bootstrapped 1000 repetitions.
Coefficients for covariates used not presented.
Sampling weights have been applied for results among the general population.

It can be seen that surveyed households scored positively on 40 per cent of the four characteristics making up the index of livelihood innovation potential. This proportion was found to be slightly higher among the members of the supported PFS and VICOBA groups, but this difference is so small that it is not clear if this represents a practical difference (the estimates vary between three and six percentage points and are not statistically significant). There is no clear difference among the general population between the project and comparison communities.

Table 6.8 presents the differences between the project and comparison communities in terms of each of the four characteristics of livelihood innovation potential.

**Table 6.8: Characteristics of innovation potential – comparison of intervention and comparison households**

| | (1) Attitude to changing livelihood practices | (2) Attitude to climate change | (3) Access to credit | (4) Use of livestock price information |
|---|---|---|---|---|
| | **Households of group members** | | | |
| *Unadjusted:* | | | | |
| Sample mean | 0.502 | 0.339 | 0.674 | 0.176 |
| Intervention mean: | 0.544 | 0.300 | 0.708 | 0.211 |
| Comparison mean: | 0.477 | 0.361 | 0.654 | 0.155 |
| Unadjusted difference : | 0.067 | -0.061 | 0.054 | 0.056 |
| | (1.01) | (-0.98) | (0.87) | (1.11) |
| **Observations:** | 245 | 245 | 242 | 245 |
| *PSM (ATT)* | | | | |
| Post-matching difference: | 0.192** | -0.081 | 0.074 | -0.043 |
| (kernel) | (2.15) | (-0.90) | (0.89) | (-0.60) |
| **Observations:** | 227 | 227 | 224 | 227 |
| | **Households among general population** | | | |
| *Unadjusted:* | | | | |
| Sample mean | 0.528 | 0.358 | 0.570 | 0.147 |
| Intervention mean: | 0.511 | 0.328 | 0.538 | 0.220 |
| Comparison mean: | 0.541 | 0.381 | 0.595 | 0.089 |
| Unadjusted difference : | -0.030 | -0.053 | -0.057 | 0.130*** |
| | (-0.53) | (-0.97) | (-1.00) | (3.16) |
| **Observations:** | 509 | 509 | 506 | 509 |
| *PSM (ATT)* | | | | |
| Post-matching difference: | 0.019 | -0.102*** | -0.100** | 0.140*** |
| (kernel) | (0.48) | (-2.71) | (-2.49) | (4.42) |
| **Observations:** | 478 | 478 | 475 | 478 |

*t* statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
PSM estimates bootstrapped 1000 repetitions.
Coefficients for covariates used not presented.
Sampling weights have been applied for results among the general population.

Attitudes to changing practices is significantly higher among PFS and VICOBA group members, but awareness of climate change is poorer.

As can be seen in columns (1) and (2) of Table 6.8, around half of the sample reached this benchmark for attitudes towards changing livelihoods practices, but only around a third did so for attitudes to climate change. The proportion of group members with positive attitudes towards changing livelihoods practices was clearly higher in the project communities than in the comparison communities. On climate change, the overall population in the project communities (though not the group members) appear to have significantly worse attitudes than the comparison communities. It is not clear why this should be, and again it seems unlikely that this represents an effect of the project.

An important characteristic enabling households to experiment with innovations in their livelihoods activities is access to credit. The DMI Livestock project sought to address this through the creation of the village community banks (VICOBAs). To test this, survey respondents were asked whether, if they wanted to invest 5000 shillings in a business opportunity, which sources they would be able to borrow this from. Households were coded with a positive score for access to credit if they reported that they would have at least two potential sources for this credit (not including household members). Column 3 of Table 6.8 shows that more of the supported group members met this benchmark than did the comparison group members. Table 6.9 analyses the number of potential sources of credit reported to be available to each household, and shows that the positive difference among the group members is even clearer.

**Table 6.9: Number of potential sources of credit – comparison of intervention and comparison households**

| | (1) **Group members** | (2) **General population** |
|---|---|---|
| *Unadjusted:* | | |
| Sample mean | 2.281 | 1.899 |
| Intervention mean: | 2.494 | 1.806 |
| Comparison mean: | 2.157 | 1.972 |
| Unadjusted difference : | 0.338* | -0.165 |
| | (1.79) | (-1.02) |
| **Observations:** | 242 | 506 |
| *PSM (ATT)* | | |
| Post-matching difference: | 0.291 | -0.263** |
| (kernel) | (1.12) | (-2.24) |
| **Observations:** | 224 | 475 |
| Post-matching difference: | 0.564** | -0.088 |
| (no replacement) | (2.39) | (-0.61) |
| **Observations:** | 228 | 474 |
| *Multivariable Regression:* | | |
| MVR coefficient : | 0.357 | -0.227 |
| (robust standard errors ) | (1.61) | (-1.37) |
| **Observations:** | 238 | 495 |
| MVR coefficient | 0.315 | |
| (robust reg.) | (1.34) | n/a |
| **Observations:** | 238 | |
| MVR coefficient : | 0.412* | -0.229 |
| (with control functions) | (1.81) | (-1.40) |
| **Observations:** | 238 | 494 |

*t* statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
PSM estimates bootstrapped 1000 repetitions.
Coefficients for covariates used not presented.
Sampling weights have been applied for results among the general population.

The analysis of outcomes has so far treated the membership of the PFS and VICOBA groups as unified. In fact this is not the case: some people participated in the PFS but not the VICOBA and vice versa. To that end, Table 6.10 performs an interaction test to investigate whether there is a particular difference in access to credit among the 80 per cent of supported group members who reported themselves to be membership of a VICOBA, as opposed to the 20 per cent who did not. The results confirm that those who report themselves to be members of a VICOBA report having access to approximately 0.5 more sources of credit on average than do corresponding comparison households. There is no evidence of such an effect among the 20 per cent of the PFS membership who did not claim to belong to a VICOBA.

Households of VICOBA members were more likely to report that they could borrow 5,000 shillings if necessary than were comparison households.

Column 4 of Table 6.8 shows (in the lower panel) that *fewer* members of the overall population in the project communities scored positively on access to credit than did the population of the comparison communities. Again, this difference between the communities does not seem likely to reflect an outcome of the project activities. Rather, this difference probably reflects an existing difference between the project and comparison communities in terms of availability of credit services.

If so, then the positive results on access to credit which were found among the VICOBA members are likely to *under*estimate the true effect of the project.

The final characteristic of livelihood innovation potential examined in Table 6.8 is access to livestock pricing information. There is no evidence of an effect on this measure among the PFS and VICOBA group members. However, in another surprising result, there appears to be a positive effect on this among community members as a whole. Again, it does not seem likely that this represents an effect of the project: perhaps the livestock pricing system is used more among the comparison communities for reasons other than in this project.

**Table 6.10: Results of VICOBA member interaction test for number of sources of credit, regressed on intervention × group member interaction variable**

| | Original intervention coefficient | Intervention coefficient with intervention × VICOBA member interaction variable | Coefficient on intervention × VICOBA member interaction variable |
|---|---|---|---|
| Access to credit – positive | 0.077<br>(1.06) | -0.073<br>(-0.54) | 0.173<br>(1.34) |
| Number of potential sources of credit | 0.357<br>(1.61) | -0.071<br>(-0.16) | 0.518<br>(1.11) |

*t* statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Coefficients for covariates not presented.

### *6.2.5 Dimension 3: Access to contingency resources and support*

Households of PFS and VICOBA members reported being involved in more community groups than corresponding comparison households, even apart from the PFS/VICOBA groups themselves.

Table 6.11 shows the estimated differences between supported and comparison households, this time in terms of characteristics of access to contingency resources and support. It is clear that significantly more members of the supported PFS and VICOBA groups score positively on this measure than do group members in comparison communities. However, among the general population, the proportions scoring positively are lower in project communities than in comparison communities – a difference that is statistically significant under the PSM kernel model.

Table 6.12 presents the results of the four characteristics making up the index of access to contingency resources and support. The first factor analysed is the household's participation in community groups. It can be clearly seen in column 1 that more of the members of supported PFS and VICOBA groups reported participating widely in community groups than did the corresponding comparison households. Particularly interesting is that even when excluding participation in the supported PFS and VICOBA groups, members of those groups in project communities *still* participate in a greater number of other groups than do the corresponding households in comparison communities. Even apart from their membership of the PFS and VICOBA groups, members of those groups report participating in between 0.1 and 0.3 more groups in the community than they otherwise would do. That may reflect participants engaging slightly more in the life of the community than they would have done without the effect of the project. It should, however, be noted that this effect is small and that the estimates are not statistically significant. At the level of the community as a whole, there is no indication of an effect on group participation.

**Table 6.11: Index of access to contingency resources and support – comparison of intervention and comparison households**

| | (1) Group members | (2) General population |
|---|---|---|
| *Unadjusted:* | | |
| Sample mean: | 0.512 | 0.385 |
| Intervention mean: | 0.559 | 0.372 |
| Comparison mean: | 0.485 | 0.395 |
| Unadjusted difference : | 0.074*** | -0.023 |
| | (2.62) | (-0.90) |
| **Observations:** | 244 | 508 |
| *PSM (ATT)* | | |
| Post-matching difference: | 0.130*** | -0.051*** |
| (kernel) | (3.32) | (-2.76) |
| **Observations:** | 226 | 477 |
| Post-matching difference: | 0.106*** | -0.024 |
| (no replacement) | (2.97) | (-1.03) |
| **Observations:** | 230 | 476 |
| *Multivariable Regression:* | | |
| MVR coefficient : | 0.094*** | -0.036 |
| (robust standard errors ) | (3.14) | (-1.62) |
| **Observations:** | 240 | 497 |
| MVR coefficient | 0.109*** | |
| (robust reg.) | (3.34) | n/a |
| **Observations:** | 240 | |
| MVR coefficient : | 0.084*** | -0.035 |
| (with control functions) | (2.80) | (-1.50) |
| **Observations:** | 240 | 496 |

*t* statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
PSM estimates bootstrapped 1000 repetitions.
Coefficients for covariates used not presented.
Sampling weights have been applied for results among the general population.

Column 2 of Table 6.12 reports the results about on the savings available to household. Households were not asked directly for the monetary value of their savings, but were instead asked, if they had a crisis and had to live on their cash savings without other income sources, how long they would be able to do so. Around a third of the group members and half of households in the general population scored positively on this measure, meaning that they could live from their savings for more than seven days. There is a slightly positive difference among the supported group members compared to the comparison group members – though the fact that there is no clear change since 2007/08 undermines confidence that this is a real result. The estimate of the difference among the general community members is negative, but not clearly statistically significant.

Of course monetary savings in a pastoralist community may be less important as a buffer against crises than small livestock, which can be sold or traded easily if the need arises. Column 3 of Table 6.12 shows the results on this measure, in which a household scored positively if they own at least ten sheep or goats or at least 20 poultry. Consistent with the measures on livestock ownership considered in Section 6.2.3, members of the PFS and VICOBA groups were found to be better off than members of the comparison groups in this regard. However, among the population as a whole, fewer of the households in the supported communities meet this cut-off than in the comparison communities.

**Table 6.12: Characteristics of access to contingency resources and support – comparison of intervention and comparison households**

| | (1) Participation in community groups | (2) Availability of savings | (3) Ownership of convertible livestock | (4) Receipt of remittances or formal earnings |
|---|---|---|---|---|
| | **Households of group members** | | | |
| *Unadjusted:* | | | | |
| Sample mean | 0.747 | 0.335 | 0.799 | 0.171 |
| Intervention mean: | 0.844 | 0.367 | 0.809 | 0.222 |
| Comparison mean: | 0.690 | 0.316 | 0.794 | 0.142 |
| Unadjusted difference : | 0.154*** | 0.051 | 0.015 | 0.080 |
| | (2.70) | (0.81) | (0.29) | (1.61) |
| **Observations:** | 245 | 245 | 244 | 245 |
| *PSM (ATT)* | | | | |
| Post-matching difference: | 0.154** | 0.091 | 0.137 | 0.151** |
| (kernel) | (2.09) | (1.11) | (1.63) | (2.57) |
| **Observations:** | 227 | 227 | 226 | 227 |
| | **Households among general population** | | | |
| *Unadjusted:* | | | | |
| Sample mean | 0.348 | 0.264 | 0.733 | 0.195 |
| Intervention mean: | 0.367 | 0.246 | 0.656 | 0.220 |
| Comparison mean: | 0.333 | 0.278 | 0.794 | 0.175 |
| Unadjusted difference : | 0.034 | -0.032 | -0.139*** | 0.046 |
| | (0.64) | (-0.63) | (-2.71) | (1.00) |
| **Observations:** | 509 | 509 | 508 | 509 |
| *PSM (ATT)* | | | | |
| Post-matching difference: | 0.030 | -0.067* | -0.135*** | -0.030 |
| (kernel) | (0.75) | (-1.92) | (-3.61) | (-0.90) |
| **Observations:** | 478 | 478 | 477 | 478 |

*t* statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
PSM estimates bootstrapped 1000 repetitions.
Coefficients for covariates used not presented.
Sampling weights have been applied for results among the general population.

The final characteristic analysed in Tables 6.12 is the availability within the household of remittances or formal employment. Approximately 15 per cent of the survey respondents reported receiving remittances from relatives outside the community during the 12 months prior to the survey, and 6 per cent reported that some household member was receiving regular earnings. While these are important factors in determining the household's level of resilience, they cannot plausibly have been affected by the DMI Livestock project. Although slightly more of the supported group members reported having access to remittances or earnings than the comparison group members, this difference is evident in the recalled 2007/08 baseline data as well, and is one of the factors which has been controlled for in the PSM and regression models. (The results estimated from the PSM no-replacement model and the regression models, not shown here, are anyway smaller in size and not statistically significant.)

### *6.2.4 Dimension 4: Integrity of the natural and built environment*

For the reasons discussed in Section 3.2, assessing the quality of the environmental resources available to households in a household survey is a considerable challenge. The sole characteristic which was collected in the questionnaire on environmental resources was the number of water sources available for grazing livestock. It is important to note that, while Oxfam has

worked on installing and rehabilitating water sources in the project area for some years, water supply activities were not specifically targeted at the communities included in the DMI Livestock project. Nevertheless, the differences between project and comparison communities in terms of households scoring positively on this characteristic are shown in Table 6.13.

**Table 6.13: Availability of water sources – comparison of intervention and comparison households**

| | (1) **Group members** | (2) **General population** |
|---|---|---|
| *Unadjusted:* | | |
| Sample mean: | 0.453 | 0.427 |
| Intervention mean: | 0.433 | 0.456 |
| Comparison mean: | 0.465 | 0.404 |
| Unadjusted difference : | -0.031 | 0.052 |
| | (-0.47) | (0.92) |
| **Observations:** | 245 | 509 |
| *PSM (ATT)* | | |
| Post-matching difference: | 0.007 | 0.080 |
| (kernel) | (0.08) | (2.06) |
| **Observations:** | 227 | 478 |
| Post-matching difference: | -0.051 | 0.087 |
| (no replacement) | (-0.60) | (1.67) |
| **Observations:** | 231 | 477 |
| *Multivariable Regression:* | | |
| MVR coefficient : | -0.013 | 0.100* |
| (robust standard errors ) | (-0.16) | (1.65) |
| **Observations:** | 241 | 498 |
| MVR coefficient : | -0.030 | 0.072 |
| (with control functions) | (-0.36) | (1.16) |
| **Observations:** | 241 | 497 |

*t* statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
PSM estimates bootstrapped 1000 repetitions.
Coefficients for covariates used not presented.
Sampling weights have been applied for results among the general population.

Project communities appear to have benefitted from borehole drilling and water source rehabilitation since 2008 to a greater extent than comparison communities.

It can be seen that approximately 43 per cent of all households scored positively (meaning that they had access to at least three different water sources in their grazing lands, including at least one modern source). There is no indication of a difference in this respect between the group members in the project communities and comparison communities, though slightly more households score positively among the project communities as a whole. It is particularly interesting to examine the reported change in the number of water sources that households have been able to access since 2008: the differences between project and comparison communities in this regard (i.e. the 'difference-in-difference measure) are shown in Table 6.14.

It is clear that households in supported and comparison communities reported an increase in the number of water sources since 2008, but that this increase was much larger among the supported communities than the comparison communities. This result probably reflects the activities of the water component of the Drought Management Initiative, under which Oxfam drilled boreholes and rehabilitated water sources across Turkana County. The communities in north Turkana being covered by the DMI Livestock project were particularly targeted for intervention under the DMI Water project.

**Table 6.14: Change in number of water sources available since 2008 – comparison of intervention and comparison households**

| | (1) Group members | (2) General population |
|---|---|---|
| *Unadjusted:* | | |
| Sample mean: | 0.359 | 0.245 |
| Intervention mean: | 0.644 | 0.337 |
| Comparison mean: | 0.194 | 0.173 |
| Unadjusted difference : | 0.451** | 0.164 |
| | (2.04) | (1.02) |
| **Observations:** | 245 | 509 |
| *PSM (ATT)* | | |
| Post-matching difference: | 0.631** | 0.227** |
| (kernel) | (2.02) | (1.98) |
| **Observations:** | 227 | 478 |
| Post-matching difference: | 0.519* | 0.170 |
| (no replacement) | (1.71) | (1.20) |
| **Observations:** | 231 | 477 |
| *Multivariable Regression:* | | |
| MVR coefficient : | 0.393* | 0.222 |
| (robust standard errors ) | (1.73) | (1.40) |
| **Observations:** | 241 | 498 |
| MVR coefficient | 0.011 | 0.168 |
| (robust reg.) | (0.06) | (1.09) |
| **Observations:** | 240 | 497 |
| MVR coefficient : | 0.315 | 0.072 |
| (with control functions) | (1.46) | (1.16) |
| **Observations:** | 241 | 497 |

*t* statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
PSM estimates bootstrapped 1000 repetitions.
Coefficients for covariates used not presented.
Sampling weights have been applied for results among the general population.

### *6.2.6 Dimension 5: Social and institutional capability*

Participation in community land-use planning meetings was generally lower in project communities than in the comparison communities.

The final dimension of resilience considered in this Effectiveness Review is the capability of institutions in the community. Only two characteristics are included under this dimension: the results for the index generated by these two measures are shown in Table 6.15. While more of the supported PFS and VICOBA group members scored positively on this measure than the comparison group members, the project communities as a whole appear to fare significantly worse on this measure than the comparison communities.

The breakdown in results of the two characteristics considered under social capability are shown in Table 6.16. Involvement of community members in land-use planning is something that the DMI Livestock project tried to influence through the establishment of Village Land-Use Planning Committees (VLUPCs). In fact there is no sign of a result among the PFS and VICOBA members (the small positive result in column 1 of Table 6.16 not being corroborated by the regression model results), and participation of the overall community in land-use planning appears to be *lower* in the project communities than in the comparison communities.

The other major way in which the DMI Livestock project was intended to affect community-level capacity was through the establishment of the PFS

**Table 6.15: Index of social and institutional capability – comparison of intervention and comparison households**

| | (1) Group members | (2) General population |
|---|---|---|
| *Unadjusted:* | | |
| Sample mean: | 0.571 | 0.438 |
| Intervention mean: | 0.617 | 0.406 |
| Comparison mean: | 0.545 | 0.464 |
| Unadjusted difference : | 0.072 | -0.058 |
| | (1.63) | (-1.52) |
| **Observations:** | 245 | 507 |
| *PSM (ATT)* | | |
| Post-matching difference: | 0.137** | -0.086*** |
| (kernel) | (2.47) | (-3.17) |
| **Observations:** | 227 | 476 |
| Post-matching difference: | 0.063 | -0.094*** |
| (no replacement) | (1.13) | (-2.61) |
| **Observations:** | 231 | 475 |
| *Multivariable Regression:* | | |
| MVR coefficient : | 0.070 | -0.076** |
| (robust standard errors ) | (1.41) | (-2.08) |
| **Observations:** | 241 | 496 |
| MVR coefficient | 0.080 | |
| (robust reg.) | (1.44) | n/a |
| **Observations:** | 241 | |
| MVR coefficient : | 0.080 | -0.078** |
| (with control functions) | (1.52) | (-2.06) |
| **Observations:** | 241 | 495 |

*t* statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
PSM estimates bootstrapped 1000 repetitions.
Coefficients for covariates used not presented.
Sampling weights have been applied for results among the general population.

The PFS and VICOBA groups appear to have continued providing training to members after the end of the project. However, this training does not appear to have been significantly disseminated to other community members.

and VICOBA groups themselves. As described in Section 2, these groups were intended to become sustainable institutions that could continue delivering training and providing access to finance after the end of the period of direct support from the project. Further, the PFS methodology encourages members who have received training directly in a PFS to propagate the training messages among their neighbours.

It is already clear from the results above that the PFS and VICOBA structures have been successfully established within the three communities supported by the DMI Livestock project. Column 2 of Tables 6.16 examines whether these structures have been promoting community-level capacity through continuing to provide training.

This indicator is positive if the respondent reported having received regular, group-based training over the 12 months prior to the survey on drought preparedness or livestock management. Significantly more of the members of the PFS and VICOBA groups scored positively on this indicator, demonstrating that these groups were still providing training to their members. However, among the households in the supported communities as a whole, the numbers who reported having received such training was lower than in the comparison communities.

**Table 6.16: Characteristics of social and institutional capability – comparison of intervention and comparison households**

| | (1) Participation in community decision-making | (2) Drought preparedness training |
|---|---|---|
| **Households of group members** | | |
| *Unadjusted:* | | |
| Sample mean | 0.690 | 0.453 |
| Intervention mean: | 0.700 | 0.533 |
| Comparison mean: | 0.684 | 0.406 |
| Unadjusted difference : | 0.016 | 0.127* |
| | (0.26) | (1.93) |
| **Observations:** | 245 | 245 |
| *PSM (ATT)* | | |
| Post-matching difference: | 0.066 | 0.208** |
| (kernel) | (0.72) | (2.33) |
| **Observations:** | 227 | 227 |
| **Households among general population** | | |
| *Unadjusted:* | | |
| Sample mean: | 0.647 | 0.230 |
| Intervention mean: | 0.617 | 0.195 |
| Comparison mean: | 0.670 | 0.257 |
| Unadjusted difference : | -0.054 | -0.062 |
| | (-0.98) | (-1.35) |
| **Observations:** | 508 | 508 |
| *PSM (ATT)* | | |
| Post-matching difference: | -0.091** | -0.082*** |
| (kernel) | (-2.39) | (-1.82) |
| **Observations:** | 477 | 477 |

*t* statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
PSM estimates bootstrapped 1000 repetitions.
Coefficients for covariates used not presented.
Sampling weights have been applied for results among the general population.

The intention in establishing PFS and VICOBA groups is that the members should disseminate the training messages they have received to their neighbours in the community. For this reason, a complementary measure included in the analysis extended the definition of 'training' to include discussions with others about training that they had received. Unfortunately there was again no difference between households in the project and comparison communities in this regard, so no evidence that the dissemination of training messages had occurred.

# 7 Conclusion and programme learning considerations

## 7.1 Conclusions

This Effectiveness Review has analysed a range of outcomes relating to households' ability to reduce risk and adapt to emerging climate trends. The fact that the comparison group differs systematically in some respects from the comparison group complicates the process of assessing the effectiveness of the DMI Livestock project, but some conclusions can nevertheless be drawn with reasonable confidence. Overall it seems that the project has had some modest impact on the resilience of households that have participated in the PFS and VICOBA groups. There is, however, little or no evidence that this has translated into improved resilience in the wider community.

It is clear that the DMI Livestock project was successful in establishing the PFS and VICOBA groups as self-sustaining institutions within the three communities: these groups were still functioning at the time of the survey (more than 12 months after the project close), and their members reported receiving continued training after that time. There is evidence that members of the VICOBA groups have improved access to credit than they otherwise would have, and perhaps also have slightly higher levels of household savings. However, the survey did not produce any evidence that PFS training messages were being successfully disseminated to other community members.

Households in the project communities reported having taken significantly more actions to prepare for the severe dry season of 2010/11 than did households in the comparison communities – and yet they also report having lost more livestock that year. This seems likely to reflect a difference in the severity of the drought, with the grazing lands used by members of the project communities lying generally further north in more exposed locations. The greater diversity of livestock owned in the project communities also seems, on balance, to reflect a systematic difference in response to the environment when compared to the comparison communities, rather than being a result of the DMI Livestock project. Further significant differences between the project and comparison communities that seem unlikely to have be directly connected to the project activities are differences in awareness and understanding of climate change, and on the use of livestock price information.

The imperfect nature of the comparison in this review means that some of the statistical results should be treated with caution.

However, a number of differences between the members of the supported PFS and VICOBA groups and the comparison groups can reasonably be attributed to the project activities. Supported group members were found to be engaged in a wider range of livelihoods activities than comparison group members – in particular, they have taken up agriculture and non-agricultural income-generating activities at a greater rate than have the comparison group members over the lifetime of the project. These group members also express more positive attitudes to adopting innovative livelihoods approaches than do the comparison group members.

At the same time, the proportion of household income that comes from livestock rearing has decreased by less than the comparison group members – suggesting perhaps that their livestock activities have become relatively more lucrative.

There is a clear difference between the members of the supported groups and members of the comparison groups in household wellbeing, as measured by ownership of household assets and the quality of housing. This is supported by the slightly better food security status of the supported group members – although levels of food security generally are very poor. The fact that the improvement in wealth indicators since 2007/08 is so much greater than among the comparison group members (despite the apparently worse experience of drought in the project communities in 2010/11) does suggest that this is likely to reflect an effect of the project activities.

The project communities appear to have suffered worse from drought in 2010/11 than comparison communities – yet the wealth indicators of PFS and VICOBA group members increased relative to those in comparison communities.

PFS and VICOBA group members were also more likely to be aware of land-use planning issues being debated in public meetings in their communities, suggesting that the capacity-building with community leaders and the establishment of the village land-use planning committees (VLUPCs) in these same communities has had some success. If so, the general population in the project communities do not seem to be aware of these efforts, and in fact report less involvement in land-use planning than do those in the comparison communities.

Significantly more of the population of the project communities report having access to the services of community animal health workers (CAHWs) than in comparison communities – and the timeliness of the services available from CAHWs is reported to be much better than that of veterinary extension workers. Also of interest is that the project communities report more of an improvement in the number of water sources available in their grazing areas than do the comparison communities. Even though Oxfam's work in drilling boreholes and rehabilitating water sources has not specifically been targeted at these three communities, it is possible that relatively more attention has been paid to the area that was covered by the DMI Livestock project.

## 7.2 Programme learning considerations

- ***Keep monitoring progress of the PFS and VICOBA groups, and whether the training and skills provided are eventually disseminated among the wider community.***

It is clear from the results that the PFS and VICOBA groups continued to function well after the end of the Oxfam project, and appear to have brought significant benefits to their members. It will be useful to conduct further follow-up research – perhaps two to three years after the end of the project – to track the further progress of these groups. In particular, it will be important to understand whether the PFS and VICOBA groups continue to operate and meet regularly, whether their membership has expanded, and (as intended under the PFS model) whether the training has started to be disseminated among other community members.

- ***Explore whether the model used for community land-use planning structures was the right one to achieve sustainable improvements.***

The results of this Effectiveness Review lend weight to the judgment made in the final evaluation of the DMI Livestock project that, without further follow-up, the activities of the village land-use planning committees (VLUPCs) may not be sustained. While reasonably high numbers of survey respondents in the project communities agreed that they are involved in decision-making on land-use planning within the community, the proportion was actually higher

in the comparison communities. This may suggest that there could be something to learn from the comparison communities in this respect.

# Appendix 1: Covariate balance following propensity-score matching procedures

## A. Group members in intervention and comparison communities

*Step 1: Backwards stepwise regression: covariate ( ) excluded from participation model if .*

```
. stepwise, pr (.25): probit intervention $covariates if groupmember==1
                      begin with full model
p = 0.9802 >= 0.2500  removing respondent_female
p = 0.9644 >= 0.2500  removing hhh_catholic
p = 0.8149 >= 0.2500  removing hhh_age
p = 0.8012 >= 0.2500  removing hhh_educ_primary
p = 0.7774 >= 0.2500  removing hh_all_elderly
p = 0.7449 >= 0.2500  removing work_iga_2008
p = 0.7038 >= 0.2500  removing ls_donkeys_2008
p = 0.7032 >= 0.2500  removing ls_shoats_2008
p = 0.6821 >= 0.2500  removing hh_single_adult
p = 0.6801 >= 0.2500  removing hhh_productive
p = 0.6569 >= 0.2500  removing work_livestock_2008
p = 0.6747 >= 0.2500  removing work_lsproducts_2008
p = 0.5405 >= 0.2500  removing work_casuallabour_2008
p = 0.5186 >= 0.2500  removing crops_num_2008
p = 0.4242 >= 0.2500  removing work_fishing_2008
p = 0.4298 >= 0.2500  removing work_remittances_2008
p = 0.4236 >= 0.2500  removing hhh_turkana
p = 0.3088 >= 0.2500  removing ls_camels_2008
p = 0.2747 >= 0.2500  removing num_educ_primary
p = 0.2841 >= 0.2500  removing hhh_literacy_write

Probit regression                                 Number of obs   =        241
                                                  LR chi2(17)     =      77.41
                                                  Prob > chi2     =     0.0000
Log likelihood = -120.01225                       Pseudo R2       =     0.2439

------------------------------------------------------------------------------
intervention |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
respondent_hhh |  -.6837502   .2604196    -2.63   0.009    -1.194163   -.1733371
work_formal_2008 |  -1.148007   .5517793    -2.08   0.037    -2.229475   -.0665399
hh_size |   .1502917   .0566418     2.65   0.008     .0392759    .2613075
num_adult |  -.4905104   .1885541    -2.60   0.009    -.8600697   -.1209512
work_service_2008 |   1.004152   .3059507     3.28   0.001     .4044997    1.603805
hhh_christian |   .4295545   .3386027     1.27   0.205    -.2340945    1.093204
hhh_female |   1.192406   .2876929     4.14   0.000     .6285386    1.756274
wife_status_first |    .364841   .2126499     1.72   0.086     -.051945    .7816271
wealth_index_2008 |   .0866931   .0534611     1.62   0.105    -.0180887    .1914749
work_relief_2008 |  -.4473005   .2197942    -2.04   0.042    -.8780893   -.0165117
ls_cattle_2008 |   .0046477   .0030955     1.50   0.133    -.0014194    .0107148
work_farming_2008 |  -.6287974   .2720885    -2.31   0.021    -1.162081   -.0955138
hhh_educ_secondary |   1.620875   .9627845     1.68   0.092     -.266148    3.507898
num_educ_secondary |  -.5083428   .3098681    -1.64   0.101    -1.115673    .0989875
farm_acres_2008 |   .3297012   .1883637     1.75   0.080    -.0394848    .6988872
num_prodadult |   .4632931    .185688     2.50   0.013     .0993513    .8272349
ls_propincome_2008 |  -.6593373   .4740191    -1.39   0.164    -1.588398    .2697231
_cons |  -1.24754   .5729573    -2.18   0.029    -2.370515   -.1245641
------------------------------------------------------------------------------
```

*Step 2: Run psmatch2 with short-listed covariates, followed by pstest to assess covariate balance.*

*pstest* output – kernel

```
 psmatch2: |   psmatch2: Common
 Treatment |        support
assignment | Off suppo  On suppor |     Total
-----------+----------------------+----------
 Untreated |         0        152 |       152
   Treated |        14         75 |        89
-----------+----------------------+----------
     Total |        14        227 |       241


-------------------------------------------------------------
             |       Mean                |     t-test
    Variable | Treated Control    %bias |    t    p>|t|
-------------+---------------------------+-----------------
respondent~h | .54667    .6006    -10.9 |  -0.66  0.507
work_fo~2008 |    .04   .02665      6.0 |   0.45  0.651
hh_size      |   7.64   7.4761      7.3 |   0.47  0.640
num_adult    |   3.44   3.1798     15.4 |   0.95  0.343
work_se~2008 | .14667   .15621     -2.7 |  -0.16  0.872
hhh_christ~n | .93333   .93942     -2.1 |  -0.15  0.880
hhh_female   | .41333   .45885     -9.5 |  -0.56  0.577
wife_statu~t |    .68   .59573     17.6 |   1.07  0.286
wealth_~2008 | .25014   .02884     10.4 |   0.60  0.550
work_relie~8 | .66667   .61545     11.4 |   0.65  0.516
ls_catt~2008 | 20.813   17.664     10.6 |   0.53  0.596
work_fa~2008 | .25333   .25004      0.7 |   0.05  0.963
hhh_educ_s~y | .01333    .0124      0.6 |   0.05  0.960
num_educ_s~y |    .08   .06964      2.7 |   0.21  0.834
farm_ac~2008 | .24267   .18089      5.1 |   0.66  0.508
num_prodad~t | 3.1733   2.9309     14.6 |   0.90  0.369
ls_prop~2008 | .50533   .48772      7.9 |   0.46  0.645
-------------------------------------------------------------
```

*pstest* output – no replacement

```
 psmatch2: |   psmatch2: Common
 Treatment |        support
assignment | Off suppo  On suppor |     Total
-----------+----------------------+----------
 Untreated |         0        152 |       152
   Treated |        10         79 |        89
-----------+----------------------+----------
     Total |        10        231 |       241


-------------------------------------------------------------
             |       Mean                |     t-test
    Variable | Treated Control    %bias |    t    p>|t|
-------------+---------------------------+-----------------
respondent~h | .55696   .53165      5.1 |   0.32  0.751
work_fo~2008 | .03797   .02532      5.6 |   0.45  0.652
hh_size      | 7.6456   7.2785     16.3 |   1.07  0.286
num_adult    | 3.4177   3.2911      7.5 |   0.47  0.642
work_se~2008 |  .1519   .12658      7.2 |   0.46  0.648
hhh_christ~n | .93671   .91139      8.6 |   0.60  0.551
hhh_female   | .43038   .36709     13.2 |   0.81  0.420
wife_statu~t |  .6962   .65823      7.9 |   0.51  0.612
wealth_~2008 | .19423  -.04372     11.2 |   0.70  0.486
work_relie~8 | .65823   .70886    -11.3 |  -0.68  0.497
ls_catt~2008 | 20.481   20.722     -0.8 |  -0.04  0.966
work_fa~2008 | .24051   .27848     -8.3 |  -0.54  0.589
hhh_educ_s~y | .01266   .01266      0.0 |  -0.00  1.000
num_educ_s~y | .08861   .10127     -3.3 |  -0.22  0.823
farm_ac~2008 | .23481   .21772      1.4 |   0.18  0.855
num_prodad~t | 3.1646   2.9873     10.7 |   0.65  0.516
ls_prop~2008 | .49747   .53544    -17.1 |  -1.07  0.288
-------------------------------------------------------------
```

## B. Non-group members in intervention and comparison communities

*Step 1: Backwards stepwise regression: covariate ( ) excluded from participation model if .*

```
. stepwise, pr (.25): probit intervention $covariates if groupmember==0
                      begin with full model
p = 0.9964 >= 0.2500  removing hhh_female
p = 0.9948 >= 0.2500  removing hhh_turkana
p = 0.9608 >= 0.2500  removing work_casuallabour_2008
p = 0.8782 >= 0.2500  removing num_educ_primary
p = 0.8839 >= 0.2500  removing hhh_literacy_write
p = 0.8766 >= 0.2500  removing hhh_productive
p = 0.8704 >= 0.2500  removing work_lsproducts_2008
p = 0.8644 >= 0.2500  removing ls_propincome_2008
p = 0.7823 >= 0.2500  removing work_remittances_2008
p = 0.7430 >= 0.2500  removing respondent_hhh
p = 0.7266 >= 0.2500  removing hh_all_elderly
p = 0.6263 >= 0.2500  removing respondent_female
p = 0.5734 >= 0.2500  removing wealth_index_2008
p = 0.6392 >= 0.2500  removing crops_num_2008
p = 0.5295 >= 0.2500  removing work_iga_2008
p = 0.5089 >= 0.2500  removing work_formal_2008
p = 0.5430 >= 0.2500  removing num_prodadult
p = 0.4146 >= 0.2500  removing ls_donkeys_2008
p = 0.4160 >= 0.2500  removing work_livestock_2008
p = 0.3547 >= 0.2500  removing work_farming_2008
p = 0.3689 >= 0.2500  removing work_fishing_2008
p = 0.2570 >= 0.2500  removing work_relief_2008
p = 0.2841 >= 0.2500  removing hhh_age
p = 0.3538 >= 0.2500  removing hh_size

Probit regression                                 Number of obs   =        257
                                                  LR chi2(13)     =      58.06
                                                  Prob > chi2     =     0.0000
Log likelihood = -147.68556                       Pseudo R2       =     0.1643

------------------------------------------------------------------------------
      intervention |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------------+----------------------------------------------------------------
      hhh_catholic |   .6794709   .3434524     1.98   0.048     .0063165    1.352625
     hhh_christian |   -.728908    .419485    -1.74   0.082    -1.551084    .0932675
num_educ_secondary |   -.189079   .1503347    -1.26   0.208    -.4837296    .1055717
         num_adult |   .2801838   .0707277     3.96   0.000       .14156    .4188075
   farm_acres_2008 |   .6510097    .263072     2.47   0.013      .135398    1.166621
   hh_single_adult |   .6640534   .3319345     2.00   0.045     .0134737    1.314633
 work_service_2008 |   .6355334   .4230447     1.50   0.133     -.193619    1.464686
 wife_status_first |  -.7954204   .2015592    -3.95   0.000    -1.190469   -.4003716
    ls_shoats_2008 |  -.0021145   .0010549    -2.00   0.045     -.004182    -.000047
    ls_camels_2008 |  -.0349588   .0184104    -1.90   0.058    -.0710426    .0011249
  hhh_educ_primary |   .6785645    .407509     1.67   0.096    -.1201384    1.477267
    ls_cattle_2008 |   .0140999    .004557     3.09   0.002     .0051683    .0230316
hhh_educ_secondary |   .8272709   .6752881     1.23   0.221    -.4962695    2.150811
             _cons |  -.5104979   .3450246    -1.48   0.139    -1.186734    .1657379
------------------------------------------------------------------------------
Note: 0 failures and 3 successes completely determined.
```

*Step 2: Run psmatch2 with short-listed covariates, followed by pstest to assess covariate balance.*

*pstest* output – kernel (observations where hh_all_elderly=1 excluded):

```
 psmatch2: |   psmatch2: Common
 Treatment |        support
assignment | Off suppo  On suppor |     Total
-----------+----------------------+----------
 Untreated |         0        146 |       146
   Treated |        13        105 |       118
-----------+----------------------+----------
     Total |        13        251 |       264


-------------------------------------------------------------
             |       Mean                |     t-test
    Variable | Treated Control    %bias |    t    p>|t|
-------------+---------------------------+----------------
hhh_catholic | .82857   .83275     -1.0 |  -0.08  0.936
hhh_christ~n | .88571   .88496      0.2 |   0.02  0.986
num_educ_s~y | .11429   .14982     -5.8 |  -0.38  0.701
num_adult    | 3.0952   3.1506     -3.5 |  -0.23  0.820
farm_ac~2008 | .16667   .14993      0.2 |   0.34  0.732
hh_single_~t | .11429   .12782     -4.7 |  -0.30  0.765
work_se~2008 | .06667   .05103      6.8 |   0.48  0.632
wife_statu~t | .58095   .61408     -7.1 |  -0.49  0.627
ls_shoa~2008 | 81.238   76.896      3.7 |   0.36  0.721
ls_came~2008 | 1.4095   1.4148     -0.1 |  -0.01  0.993
hhh_educ_p~y | .09524   .08872      2.4 |   0.16  0.871
ls_catt~2008 | 15.171   14.846      0.7 |   0.09  0.927
hhh_educ_s~y | .01905   .04989    -18.7 |  -1.22  0.223
-------------------------------------------------------------
```

*pstest* output – no replacement (observations where hh_all_elderly=1 excluded):

```
 psmatch2: |   psmatch2: Common
 Treatment |        support
assignment | Off suppo  On suppor |     Total
-----------+----------------------+----------
 Untreated |         0        146 |       146
   Treated |        18        100 |       118
-----------+----------------------+----------
     Total |        18        246 |       264


-------------------------------------------------------------
             |       Mean                |     t-test
    Variable | Treated Control    %bias |    t    p>|t|
-------------+---------------------------+----------------
hhh_catholic |    .83      .82      2.5 |   0.19  0.853
hhh_christ~n |    .88      .88      0.0 |  -0.00  1.000
num_educ_s~y |    .11      .15     -6.5 |  -0.40  0.692
num_adult    |   3.03     2.95      5.1 |   0.37  0.715
farm_ac~2008 |   .175     .137      0.4 |   0.74  0.460
hh_single_~t |    .12       .1      6.9 |   0.45  0.653
work_se~2008 |    .05      .05      0.0 |  -0.00  1.000
wife_statu~t |    .61      .68    -14.9 |  -1.03  0.303
ls_shoa~2008 |  74.05    71.69      2.0 |   0.20  0.839
ls_came~2008 |   1.49     1.25      3.1 |   0.43  0.671
hhh_educ_p~y |    .06      .07     -3.6 |  -0.29  0.776
ls_catt~2008 |  12.32    12.08      0.5 |   0.09  0.930
hhh_educ_s~y |    .01      .02     -6.1 |  -0.58  0.563
-------------------------------------------------------------
```

# Appendix 2: Cut-offs and weights used for each characteristic

| Dimension | Characteristic | Cut-off: A HH is non-deprived if... |
|---|---|---|
| Livelihood viability | • Livelihood diversification | Household engages in at least three different livelihood activities with less than or equal to 60% of household income coming from livestock. |
| | • Livestock diversification | Household has at least three types of livestock, including some goats or camels |
| | • Herd size | Household owns at least 10 large animals (cattle, camels or donkeys) or at least 50 shoats |
| | • Crop diversification | Household cultivated at least three types of crop, or at least two types of crop of which one is a drought-tolerant crop (sorghum, millet or cowpea) |
| | • Livestock vaccination and deworming | At least some of the household's livestock was vaccinated and some was dewormed during the 12 months prior to the survey. |
| | • Access to curative veterinary care | Household made use of a CAHW or veterinary extension officer during the 12 months prior to the survey, and reported that the service was always available when it was needed. |
| | • Access to early-warning information | Household received early-warning or seasonal forecasting information during the 12 months to the survey, from either a radio programme or an extension worker, and reported that the information was available when it was needed. |
| | • Drought preparedness practice | Household reported taking at least two actions to manage risk ahead of the dry season of 2010/11.. |
| | • Livestock lost to drought | Household reported losing fewer than five large animals (cattle, camels or donkeys) and fewer than 20 sheep and goats during the dry season of 2010/11. |
| | • Household wealth status | Household owns at least at least three small assets at least one large asset.[10] |
| | • Household food security | Household reports having had to cut the size of meals, eat fewer meals, having had no food in the house, having gone to sleep hungry, or having not had any food during a whole day and night fewer than three times in the month prior to the survey. |
| Innovation potential | • Attitudes towards new livelihood practices | Respondent either agrees or strongly agrees with at least two of the three statements about adopting new livelihoods practices (Likert scale). |
| | • Awareness of climate change | Respondent either agrees or strongly agrees with at least two of the three statements about climate change (Likert scale). |
| | • Access to credit | Respondent reports that the household could borrow KShs 5000 from one of at least two different sources, if required for a business investment. |
| | • Use of livestock price information | Household made use of livestock price information during the 12 months prior to the survey, and reports that the information was always available when required. |

[10] One recognised way of measuring a household's wealth status is by examining the assets it owns. The 'small assets' considered here include: watch, stool, chair, table, mattress, bed, mobile phone, radio, television, bicycle, iron box, solar panel, sewing machine. The 'large assets' include motorcycle, motor vehicle, generator or fishing boat. As discussed in Section 6.3.3, data were collected on a larger number of assets and other household wealth indicators. The lists of assets defined here were selected as those most likely to differentiate poorer household from those that are better off. The binary wealth status indicator is also significantly correlated with the index of overall household wealth at the time of the survey (*t*-statistic = 22.69; R2 = 0.5255).

| Dimension | Characteristic | Cut-off: A HH is non-deprived if... |
|---|---|---|
| Access to contingency resources and support | • Group participation | Household participates in at least five types of group in the community. |
| | • Savings | Household has savings enabling them to survive for at least seven days in the event of a crisis. |
| | • Remittances or formal earnings | Household received remittances from outside the community during the 12 months prior to the survey, or some household member has regular salaried employment. |
| | • Ownership of convertible livestock | Household owns at least 10 sheep or goats or 20 poultry birds. |
| Integrity of the natural and built environment | • Availability of water for livestock | Household has access to at least three different sources of water in the areas of the grazing lands, at least one of which is a modern source (borehole or water pan). |
| Social & institutional capability | • Participation in community decision-making | Household agrees or strongly agrees with both of the statements about participation in land-use planning and general decision-making in the community (Likert scale). |
| | • Received training on drought preparedness and/or livelihoods issues | Some household member received regular training on drought preparedness or livestock management during the 12 months prior to the survey. |

# Appendix 3: Other measures pertaining to the livelihood viability dimension

It is worth reviewing the results of analyses that were carried out on several other outcome variables that are related to the livelihood viability dimension. These include those relating to household food insecurity, household wealth indicators, and reported ability to meet household needs.

The survey questions on household food security were adapted from the Household Food Insecurity Access Scale (HFIAS) developed by USAID's Food and Nutrition Technical Assistance (FANTA) Programme.[11] This module involves asking the respondents the following questions using a four week recall period:

1. Did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?
2. Did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?
3. Did you or any household member have to eat fewer meals in a day because there was not enough food?
4. Was there ever no food to eat of any kind in your house because of lack of resources to get food?
5. Did you or any household member go to sleep at night hungry because there was not enough food?
6. Did you or any household member go a whole day and night without eating anything because there was not enough food?

If the question was answered in the affirmative, the respondent was then asked how frequently the situation occurred during the previous four weeks. Scores were given based on their particular responses, with a score of 1 for once or twice, 2 for three to 10 times, and 3 for over 10 times. Consequently, the higher the household's score, the more food insecure it is considered to be. Figure A3.1 presents a histogram of the resulting raw scores, revealing that there is some variation in reported household food security.

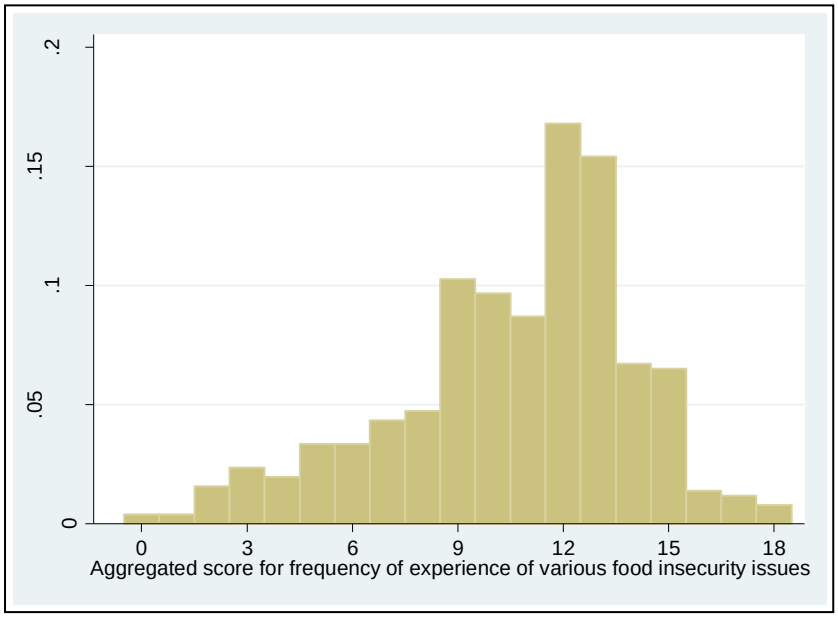



**FIGURE A3.1: Histogram of raw household food insecurity scores**

[11] http://www.fantaproject.org/publications/hfias_intro.shtml

The data obtained through HFIAS was also used to create two binary measures of severe household food security. A household was coded as reaching the benchmark for resilience in terms of food security if they the respondent reported that none of the following had occurred to any household member in the four weeks prior to the survey, or that they had occurred only once or twice in that time:

- There was no food of any kind in the home;
- The household cut down the size of meals or the number of meals consumed;
- Household members went to bed hungry or went for a whole day and night without eating.

A household was further coded as experiencing severe food insecurity if the respondent reported that:

- Household members had to reduce the number of meals consumed or had no food of any kind in the home more than 10 times in the past four weeks; or
- Household members went to bed hungry or did not eat anything during a whole day and night three or more times in the past four weeks.

**Table A3.1: Indicators of food security and wellbeing indicators – comparison of intervention and comparison group members**

| | (1) **Food security – positive** | (2) **Food insecurity score** | (3) **Severe food insecurity** | (4) **Wealth index – positive** | (5) **Wealth index** | (6) **Change in wealth index since 2008** | (7) **Ability to meet basic needs** |
|---|---|---|---|---|---|---|---|
| | Probit | OLS | Probit | Probit | OLS | OLS | Ordered probit |
| *Unadjusted:* | | | | | | | |
| Sample mean | 0.065 | 10.471 | 0.703 | 0.273 | 0.260 | 0.195 | 2.016 |
| Intervention mean: | 0.089 | 10.135 | 0.693 | 0.378 | 0.836 | 0.688 | 2.122 |
| Comparison mean: | 0.052 | 10.665 | 0.709 | 0.213 | -0.075 | -0.092 | 1.955 |
| Unadjusted difference : | 0.037 | -0.530 | -0.015 | 0.165*** | 0.911*** | 0.780*** | 0.168** |
| | (1.14) | (-1.21) | (-0.25) | (2.82) | (2.69) | (2.79) | (1.98) |
| **Observations:** | 245 | 244 | 239 | 245 | 245 | 245 | 244 |
| *PSM (ATT)* | | | | | | | |
| Post-matching difference: | 0.047 | -0.943* | -0.079 | 0.141* | 0.814 | 0.837** | 0.269* |
| (kernel) | (1.26) | (-1.69) | (-1.03) | (1.83) | (1.56) | (2.24) | (1.95) |
| **Observations:** | 227 | 226 | 221 | 227 | 227 | 229 | 226 |
| Post-matching difference: | 0.025 | -0.885 | -0.078 | 0.127 | 0.843* | 0.688* | 0.165 |
| (no replacement) | (0.59) | (-1.55) | (-0.96) | (1.62) | (1.78) | (1.77) | (1.55) |
| **Observations:** | 231 | 230 | 225 | 231 | 231 | 233 | 230 |
| *Multivariable Regression:* | | | | | | | |
| MVR coefficient : | 0.000 | -0.791* | -0.017 | 0.272*** | 0.690** | 0.896*** | -0.039 |
| (robust standard errors ) | (0.83) | (-1.80) | (-0.23) | (2.99) | (2.43) | (2.70) | (1.36) |
| **Observations:** | 226 | 240 | 231 | 237 | 241 | 241 | 240 |
| MVR coefficient | | -0.879* | | | 0.269* | 0.682*** | |
| (robust reg.) | n/a | (-1.78) | n/a | n/a | (1.77) | (3.65) | n/a |
| **Observations:** | | 240 | | | 241 | 241 | |
| MVR coefficient : | 0.000 | -0.921** | -0.036 | 0.312*** | 0.756** | 0.970*** | -0.034 |
| (with control functions) | (1.37) | (-2.06) | (-0.48) | (3.18) | (2.46) | (2.68) | (1.15) |
| **Observations:** | 226 | 240 | 231 | 237 | 241 | 241 | 240 |

*t* statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
PSM estimates bootstrapped 1000 repetitions.
Coefficients for covariates used not presented.

**Table A3.2: Indicators of food security and wellbeing – comparison of intervention and comparison households in the general population**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| | **Food security – positive** | **Food security score** | **Severe food insecurity** | **Wealth index – positive** | **Wealth index** | **Change in wealth index since 2008** | **Ability to meet basic needs** |
| | Probit | OLS | Probit | Probit | OLS | OLS | Ordered probit |
| *Unadjusted:* | | | | | | | |
| Sample mean | 0.085 | 10.686 | 0.739 | 0.172 | -0.198 | -0.149 | 1.956 |
| Intervention mean: | 0.093 | 10.669 | 0.712 | 0.216 | 0.108 | 0.121 | 1.938 |
| Comparison mean: | 0.079 | 10.700 | 0.760 | 0.138 | -0.439 | -0.361 | 1.971 |
| Unadjusted difference : | 0.014 | -0.031 | -0.049 | 0.078* | 0.547* | 0.481* | -0.033 |
| | (0.42) | (-0.08) | (-0.95) | (1.81) | (1.71) | (1.94) | (-0.45) |
| **Observations:** | **509** | **506** | 499 | **509** | 509 | 509 | **507** |
| *PSM (ATT)* | | | | | | | |
| Post-matching difference: | -0.004 | 0.257 | -0.041 | 0.069** | 0.157 | 0.240 | -0.068 |
| (kernel) | (-0.18) | (0.88) | (-1.15) | (2.17) | (0.59) | (1.22) | (-1.26) |
| **Observations:** | 478 | 475 | 468 | 478 | 478 | 480 | 476 |
| Post-matching difference: | 0.007 | 0.328 | -0.034 | 0.070* | 0.467 | 0.409* | -0.083 |
| (no replacement) | (0.22) | (0.84) | (-0.72) | (1.73) | (1.55) | (1.75) | (-1.22) |
| **Observations:** | 477 | 474 | 467 | 477 | 477 | 479 | 475 |
| *Multivariable Regression:* | | | | | | | |
| MVR coefficient : | -0.000 | 0.298 | -0.047 | 0.108** | 0.306 | 0.349* | 0.016 |
| (robust standard errors ) | (-0.40) | (0.70) | (-0.91) | (2.56) | (1.60) | (1.68) | (-0.46) |
| **Observations:** | 491 | 495 | 488 | 498 | 498 | 498 | 496 |
| MVR coefficient : | -0.000 | 0.276 | -0.051 | 0.124*** | 0.308 | 0.340 | 0.014 |
| (with control functions) | (-0.24) | (0.64) | (-0.97) | (2.60) | (1.57) | (1.62) | (-0.37) |
| **Observations:** | 490 | 494 | 487 | 497 | 497 | 497 | 495 |

*t* statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
PSM estimates bootstrapped 1000 repetitions.
Coefficients for covariates used not presented.
Sample weights have been applied.

The results for the three food security measures are shown in the first three columns of Tables A3.1 and A3.2. In column 1, it can be seen that only 6.5 per cent of the group members and 8.5 per cent of the overall sampled population reached the benchmark for positive food security (i.e. few food security questions). There is no clear difference between the supported and comparison households in this respect.

Column 2 of both tables shows the difference between supported and comparison households in the overall food insecurity scores (i.e. the scores that are plotted for the sample as a whole in Figure A3.1 above). The food insecurity score appears to be lower (that is, food security is better) in the households of supported group members than the households of comparison group members. The estimates of this difference are mostly statistically significant at the 10 per cent level, so this can be cautiously taken to represent a genuine difference between the supported and comparison households. Finally, column 3 analyses the figures for severe food insecurity. Approximately 70 per cent of the households of group members report suffering from severe food insecurity, as do 74 per cent of the general population. There are some signs that the incidence of severe food insecurity may be slightly lower in the supported communities – but the evidence for this conclusion is marginal, and the estimated size of the effect is anyway very small.

For the household wealth index, data were collected on the household's ownership of various assets and on other wealth indicators (particularly housing conditions). Respondents were asked about their ownership of

these assets and their situation on the other indicators both at the time of the survey, and at baseline in the year 2008. At the analysis stage, households were divided into two or three quantiles in each time period, based on the quantity owned of each type of asset, or the value of each wealth indicator. The correlations between the quantiled variables for the variables types of asset and wealth indicators were then analysed using Cronbach's alpha, a coefficient of reliability.[12] At this stage, asset types were excluded if they were either negatively correlated or weakly correlated with the others, suggesting that they are not good indicators of wealth. Unusually in this case, livestock (with the exception of poultry) were also found to be negatively correlated with ownership of other assets, and so they were excluded from the wealth indices. This is probably due to the extreme importance of livestock in pastoralist households as a productive asset, which confounds using livestock ownership as a wealth indicator.

Table A3.3 shows the assets and other wealth indicators which were used to construct the wealth indices. The overall value for Cronbach's alpha is 0.81, which shows that the variables items are reasonably well-correlated. The alpha for the baseline (2007/08) index is 0.67 and that for the index of differences is 0.71.

**Table A3.3: Inter-item correlations of household wealth indicators used to construct wealth index for 2012**

| Item | Obs | Sign | item-test correlation | item-rest correlation | average inter item covariance | alpha |
|---|---|---|---|---|---|---|
| File | 509 | + | 0.2508 | 0.1542 | 0.027819 | 0.8118 |
| Machete | 509 | + | 0.4133 | 0.3244 | 0.026603 | 0.8042 |
| Rake | 509 | + | 0.4245 | 0.3517 | 0.026814 | 0.8029 |
| Fishing net | 509 | + | 0.1486 | 0.126 | 0.028717 | 0.8095 |
| Axe | 509 | + | 0.2226 | 0.1319 | 0.028041 | 0.812 |
| Fishing boat[b] | 509 | + | 0.215 | 0.1994 | 0.02869 | 0.8091 |
| Watch[a] | 509 | + | 0.508 | 0.4647 | 0.027065 | 0.8012 |
| Mat | 509 | + | 0.5387 | 0.4434 | 0.025183 | 0.7985 |
| Pots | 509 | + | 0.4277 | 0.3315 | 0.026353 | 0.8041 |
| Stool[a] | 509 | + | 0.5445 | 0.4599 | 0.025405 | 0.7976 |
| Chair[a] | 509 | + | 0.687 | 0.6434 | 0.025495 | 0.7926 |
| Mobile phone[a] | 509 | + | 0.7056 | 0.6618 | 0.025237 | 0.7913 |
| Table[a] | 509 | + | 0.7151 | 0.6725 | 0.025195 | 0.7909 |
| Radio[a] | 509 | + | 0.5194 | 0.4733 | 0.02689 | 0.8004 |
| Mattress[a] | 509 | + | 0.7209 | 0.6762 | 0.024959 | 0.7899 |
| Television[a] | 509 | + | 0.3469 | 0.3325 | 0.028532 | 0.8081 |
| Bed[a] | 509 | + | 0.5638 | 0.5269 | 0.026974 | 0.8002 |
| Bicycle[a] | 509 | + | 0.4172 | 0.3858 | 0.02789 | 0.805 |
| Motorbike[b] | 509 | + | 0.2184 | 0.1953 | 0.028585 | 0.8087 |
| Lamp | 509 | + | 0.4943 | 0.4635 | 0.027603 | 0.8034 |
| Car or other motor vehicle[b] | 509 | + | 0.1487 | 0.1415 | 0.028853 | 0.8099 |
| Iron box[a] | 509 | + | 0.3136 | 0.2898 | 0.028376 | 0.8075 |
| Solar panel[a] | 509 | + | 0.3665 | 0.3464 | 0.028348 | 0.8072 |
| Sewing machine[a] | 509 | + | 0.2356 | 0.2217 | 0.028691 | 0.8091 |
| Generator[b] | 509 | + | 0.3005 | 0.2889 | 0.028661 | 0.8088 |
| Rooms in house | 509 | + | 0.2725 | 0.1446 | 0.027563 | 0.8165 |
| Type of walls | 509 | + | 0.36 | 0.2169 | 0.026596 | 0.8157 |
| Type of roof | 509 | + | 0.4515 | 0.3624 | 0.026258 | 0.8024 |
| Type of floor | 509 | + | 0.2998 | 0.2732 | 0.028353 | 0.8075 |
| Source of drinking water | 509 | + | 0.3292 | 0.1985 | 0.026985 | 0.8143 |
| Cooking fuel | 509 | + | 0.4069 | 0.3649 | 0.027637 | 0.8043 |
| Type of toilet | 509 | + | 0.5023 | 0.4263 | 0.026083 | 0.7996 |
| Poultry | 509 | + | 0.4039 | 0.2914 | 0.026357 | 0.8073 |
| **Test scale** | | | | | **0.027176** | **0.8096** |

[12] When items are used in a scale or index, they should all measure the same underlying latent construct (e.g. household wealth status). The items, then, must be significantly correlated with one another. Cronbach's alpha is a measure of this inter-item correlation. The more the variables are correlated, the greater is the sum of the common variation they share. If all items are perfectly correlated, alpha would be 1 and 0 if they all were independent from one another. For comparing groups, an alpha of 0.7 or 0. 8 is considered satisfactory. See: Bland, M. J. & Altman, D. G. 1997. Statistics notes: Cronbach's alpha. *BMJ,* 314, 572.

Once the asset types and other wealth indicators to be included in the wealth index had been determined, principal component analysis (PCA) was run on these variables to derive overall wealth indices for 2008, for the time of the survey, and for the change over the period.

For the purposes of the resilience index, a further indicator was created for asset wealth, whereby a household was considered to have reached the benchmark if they owned three of more of a variety of 'small' household assets (those marked with superscript *a* in Table A3.3) or at least one 'large' asset (those marked with superscript *b* in Table A3.3). The results from the analysis of this measure is shown in column 4 of Tables A3.1 and A3.2. As can be seen, 27 per cent of the households of group members reached this benchmark, but only 17 per cent of the overall population. More of the supported group members reached this benchmark than did the comparison group members, though estimates of this difference vary widely (between 13 and 31 percentage points). When the overall wealth index is examined (in column 5), this difference is clearer, and even more so when the change in wealth index since 2008 is examined (column 6). There are also some indications, from columns (4) to (6) of Table A3.2, of a positive difference among the general population. Table A3.4 applies an interaction test, and finds that, if there is a change in the wealth index for the average community member, this is mostly accounted for by the change in the group members, rather than representing an overall change in their neighbours in the community.

**Table A3.4: Results of group member interaction test for change in wealth index, regressed on intervention × group member interaction variable**

| | Original intervention coefficient | Intervention coefficient with intervention × group member interaction variable | Coefficient on intervention × group member interaction variable |
|---|---|---|---|
| Change in wealth index since 2008 | 0.349*<br>(1.68) | 0.286<br>(1.29) | 0.700*<br>(1.74) |

*t* statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Coefficients for covariates not presented.

The final measure of wellbeing examined in this Effectiveness Review was a more subjective measure of whether the respondent's household is able to meet its needs from current income. Respondents were asked to select which of these four options best described the situation of their household:

- Doing well: able to meet household needs by your own efforts, and making some extra for stores, savings, and investment.
- Breaking even: able to meet household needs but with nothing extra to save or invest.
- Struggling: managing to meet household needs, but depleting productive assets and/or sometimes receiving support.
- Unable to meet household needs by your own efforts: dependent on support from relatives living outside of your household or the community, government and/or some other organisation – could not survive without this outside support.

Each household was allocated points on a scale of zero to three, with higher points corresponding to better options. However, as can be seen in column 7 of Tables A3.1 and A3.2, there are no clear differences between the supported and comparison households on this measure.