# Improving productivity through group lending:

# Report on the Impact Evaluation of the Cocoa Abrabopa Initiative

Emmanuel Opoku
Research, Monitoring and Evaluation Department
Ghana Cocoa Board

Richman Dzene
Ghana Institute of Management and Public Administration

Stefano Caria, Francis Teal and Andrew Zeitlin
Centre for the Study of African Economies
University of Oxford

April 21, 2009

# Contents

## Acknowledgements

Many individuals contributed to the process of data collection, analysis, and critical review that are embodied in this report.

We gratefully acknowledge funding from the Bill and Melinda Gates Foundation and the UK Department for International Development under its "Improving Institutions for Pro-Poor Growth" Research Programme Consortium. The Ghana Cocoa Board has provided personnel and other resources for fieldwork and analysis. We are also grateful to the Cocoa Abrabopa Association for making available personnel, data, and other resources without which the study could not have been completed.

Mark Fiorello provided exceptional research assistance as field manager for the project. We are also grateful to Dennis Allotey, Francis Amponsah, Romeo Anku, Simon Crown, Samuel Darko, Ishmael Laryea, Isaac Manu, Samuel Otchere, and Obodai Sai Theophilus for countless long hours in the conduct of the fieldwork. As ever, Moses Awoonor-Williams provided invaluable advice and assistance in the logistical management of the fieldwork. We are also particularly grateful to Paolo Falco for his contribution to the analysis, dissemination, plans for subsequent research.

Finally, we are grateful to participants at a workshop held in February, 2009, to discuss preliminary results from this study and from related work of other stakeholders in the sector.

## Executive summary

This report provides the results of an impact evaluation studying the Cocoa Abrabopa Association, a private-sector initiative in Ghana's cocoa industry. The analysis is part of work undertaken as part of the Ghana Cocoa Farmers Survey 2008. This survey is the fourth round of a collaboration between the Ghana Cocoa Board and the Centre for the Study of African Economies, Oxford University.

Cocoa Abrabopa (CAA) provided a bundle of inputs to farmers based on the Hi-Tech package developed by the Cocoa Research Institute of Ghana. The inputs were given on credit to groups of farmers, who were jointly liable for their repayment. In the first year of membership, farmers were given inputs applicable to a total of 2 acres of cocoa farm land; this quantity may be increased for the group in subsequent years. In addition, farmers in the first year of membership received training in input application methods, as well as bookkeeping skills and other aspects of business training – the latter of which were provided to members by TechnoServe Ghana. With this combined product, CAA has seen rapidly expanding membership: from an initial membership of 1,440 in the 2006/07 season, to 6,300 in 2007/08 to 10,923 in 2008/09 (Cocoa Abrabopa Association 2009) [1].

We find evidence of large agronomic and economic returns to participation in the program. Our preferred estimates suggest that members' output increased by 638.5 kg relative to what we estimate would have been their output levels had they not participated in the program. This represents a substantial increase over previous production – on the order of a 20% rise in the *total* production of the farm, including lands not directly receiving CAA inputs. Moreover, even after examining changes in labour and spot-market purchases of other inputs, we estimate an average rate of return on CAA loans of approximately 176%. Taken on average, member farmers appear to benefit significantly from CAA membership.

In light of these positive average returns, there is a striking puzzle to be explained: while (only) 14% of member farmers in villages first exposed to CAA in 2007/08 experienced problems repaying their loans, a further 18% who did not experience such problems did not re-enroll in CAA for the 2008/09 season. Although the part of our sample that can be used to analyze this problem is inherently limited, we present some suggestive evidence. Farmers who experience low returns as individuals are vastly more likely to drop out of the program. The data are consistent with the view that farmers face heterogeneous and uncertain returns to participation in CAA, and that they learn about the profitability of the Hi-Tech package on their particular farms on the basis of their experiences with CAA.

We conclude by highlighting open questions and areas for future work. First, it is not known the extent to which returns to membership in the program show further increases when farmers participate over a period of several years. We propose to address this by collecting additional panel data in September 2009, to track progress of member farmers over the 2008/09 season. Second, since dropout rates remain high in spite of apparently large returns, we propose to design and undertake an informational intervention in December 2009, aimed at increasing retention of CAA members by improving their knowledge of the performance of the program. And third, it is our view that risk may be a significant deterrent to the 'scaling up' of the CAA program, particularly insofar as it requires increasing average loan sizes. We propose to work with CAA and with TechnoServe to develop a weather-indexed insurance product for offer to CAA members in the 2010/11 cocoa season.

# 1 Introduction and problem statement

The search by Ghana for a workable technology to raise and sustain farmer productivity has generated considerable interest among industry stakeholders. Origin countries and consumers are analyzing effects of the policy initiative on global cocoa supply. On the other hand, policy analysts are interested in their effectiveness to lead a real change in productivity.

Recorded productivity of Ghanaian cocoa farmers, averaging 400kg per hectare is considered among the lowest in the world. It sharply contrasts 800kg to 2,500kg per ha farmers in South East Asia and the Caribbean have achieved. Many reasons, including low per capita usage of fertilizers by farmers, have been advanced to explain this trend.

Ghana Cocoa Board (COCOBOD) with support from government has over time introduced some strategic interventions to support cocoa farmers to increase productivity. Under this strategy, progressive producer pricing, public support for diseases and pests control and subsidies on fertilizer has featured prominently. Further to these, recent cocoa sub-sector policies have tended to encourage public-private sector partnership in the delivery of inputs and transfer of technology to farmers. From hindsight, these interventions may suffice as the panacea to the lower farmer productivity. However, the farmer's capacity to adopt the technology being implemented under the interventions is essential to determining the level of success.

The small holdings of most Ghanaian cocoa farmers make them lack the financial ability to pre-finance hi-technology inputs. The question then arises that to what extent should the farmers be supported financially to encourage the adoption of productivity enhancing technologies in a cost effective manner.

The Cocoa Abrabopa Association, an initiative of Wienco Ghana Limited, was established to complement ongoing interventions and minimize the existing credit gap. It offers input package on revolving credit terms and education to its member-farmers. The education component promotes adoption of good agricultural practices with emphasis on effective techniques of input application, farm maintenance and bookkeeping. While the Association delivers inputs and extension, it collaborates with TechnoServe (NGO) to educate the members to treat cocoa farming as a business.

Ghana Cocoa Board in 2007 undertook an evaluation of the Cocoa Abrabopa project, and in collaboration with the CSAE, expanded the scope of 2008 evaluation. The evaluation essentially analyzes the impacts of Cocoa Abrabopa intervention to establish whether the treatment is leading a real change in productivity. It also examines the important questions of sustainability in relation to ability to achieve full recovery of credit.

This collaboration extends the three wave panel study of cocoa farmers, jointly undertaken, between 2002 and 2006. It highlights, among others, important questions for the design of contract mechanisms and alternate financial products that could improve productivity in the cocoa sub-sector.

The impacts of Cocoa Abrabopa address the following questions in detail: What was the average effect of membership in the programme on cocoa production? How did this effect vary across individuals? How was this effect obtained: what happens to other inputs and outputs on non-Abrabopa member farmers?

Establishing the impacts of Cocoa Abrabopa requires answering a *counterfactual question:* What would farmers who joined Cocoa Abrabopa Association have looked like in the absence of the programme? Since a direct answer is far fetched, it is prudent to establish a valid comparison group.

In doing so some inherent biases (misleading comparators) are identified. For instance, non-members in the villages: what if people who join are fundamentally different? What about cocoa farmers in other villages without comparison. It may also be the same farmers before versus after the intervention: possibility of mistaking general improvements in the sector (or weather) for programme.

### 1.1 Motivation

The 2007 evaluation by COCOBOD found evidence of significant productivity impact but raised questions. A 17% of farmers did not even have sufficient revenue in time to repay their debts. Others reinvested in farm expansion instead of repaying the debt. This suggested several questions motivating the current evaluation – how big are the impacts and for whom? Under what conditions are farmers likely to repay their loans? How does group formation affect the performance of the programme?

### 1.2 Support for Agriculture Investment

Like other sub-sectors of agriculture, the cocoa sub-sector has over time faced credit constraints. Agriculture share of total private sector credit has declined consistently over the last decade. Agriculture accounts for 35% of GDP and 60% of employment, only 6% of bank credit goes to the sector (Bank of Ghana, 2007). However, lack of access to credit for key agric sector activities including farming, fishing, livestock and good agriculture infrastructure has a drag on productivity growth and incomes in the sector.

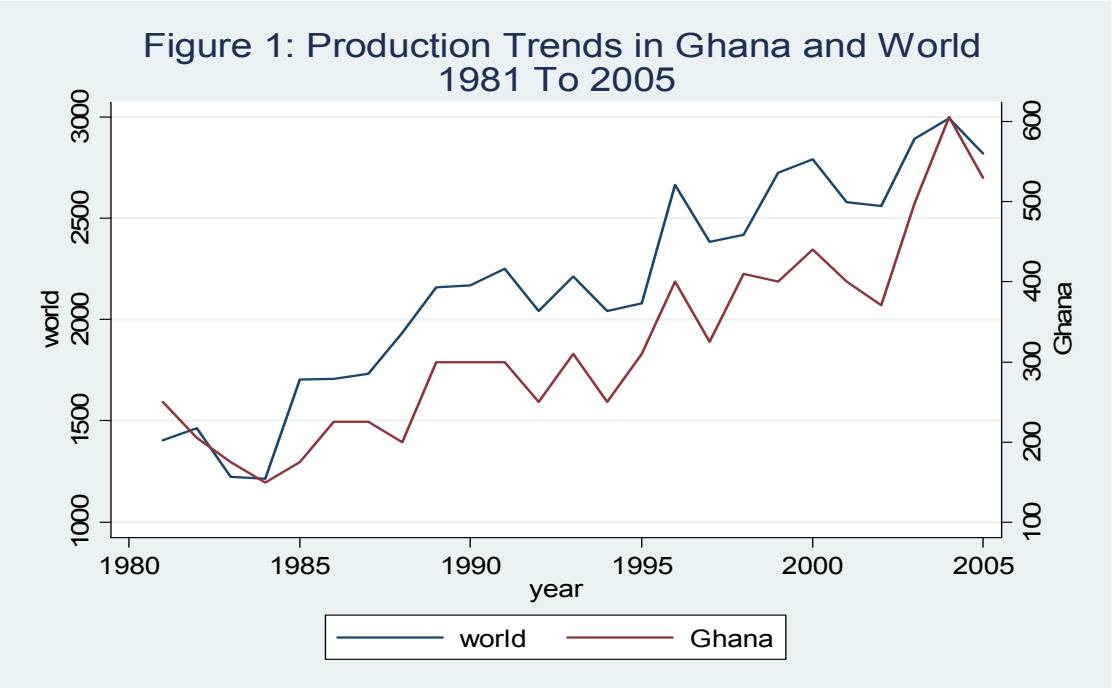
This is explained largely by the classification of agriculture as high risk investment essentially due to low production technology and diseconomy of scale. Also, consistently low productivity

has neither helped official interventions to avail credit to farmers as financial intermediaries shy away from the risk.

### *1.3 Trends in cocoa production*

Over the last decade the industry has witnessed significant growth in volume, averaging about 620,000 tonnes per annum and achieving record production of 740,000 tonnes in 2005/06. This is attributed in part to good weather condition, result of policy interventions that introduced government spray program and increased application of fertilizer by farmers. It is notable also the spray program enticed farmers to adopt cultural practices and increased use of paid labour as major contributors. Cocoa production trend is shown in figure 1 and 2. Performance dipped in 2006/2007 cocoa season with production peaking at 630,000 tonnes. This was attributed to long dry season and some other structural rigidity. Based on current trends production forecast is expected to grow to about a 1,000,000 by 2010.

The cocoa sub-sector is the largest contributor to agriculture GDP of Ghana. It attracts greater attention of government as amply demonstrated in sector policies government has pursued for the past decade. In aggregate, these measures have facilitated tremendous improvements in cocoa outcomes (see figure 1).



## 1.4 Overview of the Cocoa Sub-Sector

The contribution of agriculture to GDP has remained constant over last six years averaging about 35% per annum. Considering the levels of sub-sector contributions to growth, cocoa production and marketing, forestry and logging sub-sectors underperformed between 2004 and 2007. The cocoa sub-sector contributed 4.4% to GDP in 2006 and declined 0.1% point to 4.3%. In terms of its contribution to growth, the sub-sector's contribution increased from 0.1% to 0.2% between 2006 and 2007. This growth level is not strong to generate, or attract badly needed capital to the sector.

**The Cocoa Sub-Sector**

| Activity | Sub-sector share of GDP | | | | | Contribution to Growth | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2004 | 2005 | 2006 | 2007 | 2008 | 2004 | 2005 | 2006 | 2007 | 2008 |
| AGRICULTURE | 36.6 | 36 | 35.4 | 34.7 | | 2.6 | 1.5 | 1.6 | 1.4 | |
| Agriculture &Livestock | 24.4 | 23.8 | 23 | 22.7 | | 1 | 0.8 | 0.8 | 0.9 | |
| **Cocoa Production and Marketing** | **4.3** | **4.6** | **4.4** | **4.3** | | **1.3** | **0.6** | **0.1** | **0.2** | |
| Forestry & Logging | 3.6 | 3.6 | 3.4 | 3.3 | | 0.2 | 0.2 | 0.1 | 0.1 | |
| Fishing | 4.4 | 4.1 | 4.4 | 4.4 | | 0.3 | 0 | 0.7 | 0.2 | |

**Source: Ministry of Finance and Economic Planning**

## 1.5 Sectoral distribution of credit

In recent years, credit inflow for investment in the cocoa sub-sector has been increasing at a decreasing rate relative to other sectors. Between 1998 and 2000, total credit to the cocoa sub-sector declined from about ¢47 billion to ¢45 billion. Nonetheless, it rose after 2000, the rate of growth however increased at an annual decreasing rate of about 0.2%.

**Table 2: Sectoral distribution of credit**

| SECTOR | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|
| Agric, Forestry & Fishery | 24.4 | 42.1 | 79.7 | 152 | 221.2 | 340.06 | 486.49 |
| Export Trade | 20 | 30.8 | 58.5 | 48.7 | 35.4 | 90.77 | 114.86 |
| Manufacturing | 86.6 | 129.3 | 227.1 | 288.6 | 445.1 | 717.11 | 1416.95 |
| Transport, Storage & Communication | 8.3 | 8 | 13.7 | 20 | 37.6 | 76.49 | 154.58 |
| Mining & Quarrying | 5.4 | 6.5 | 29 | 65.7 | 90.7 | 166.96 | 279.32 |
| Import Trade | 18.9 | 23.6 | 34.5 | 53.3 | 99.3 | 128.37 | 275.12 |
| Construction | 43.6 | 50.8 | 72.2 | 125.4 | 202.3 | 257.23 | 340.77 |
| Commerce & Finance | 42.7 | 61.9 | 97 | 181.5 | 280.6 | 451.44 | 849.35 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Electricity, Gas & Water | 6.2 | 6.3 | 14.3 | 20.4 | 75.5 | 122.03 | 230.24 |
| Services | 18.6 | 33.2 | 68.3 | 118 | 155.9 | 268.55 | 458.22 |
| Miscellaneous | 12.9 | 19.2 | 29 | 46.4 | 116.2 | 231.02 | 396.03 |
| Cocoa Financing | 7.8 | 20.9 | 9.1 | 87.3 | 47.9 | 33.87 | 42.09 |
| 13.TOTAL | 295.2 | 432.5 | 732.4 | 1,207.20 | 1,807.60 | 2,883.90 | 5,044.00 |

Source: Ministry of Finance and Economic Planning

# 2 Survey Descriptive

In this section, brief analyses of the observed characteristics of the Abrabopa and non Abrabopa farmers for two cocoa seasons are presented. It shows household characteristics and their implication for group formation; labour and non labour inputs usage and plot and output distribution across the treatment and control groups over the two seasons.

## *2.1 Sample design*

The principal challenge facing impact evaluation is to identify an answer to the *counterfactual question*, namely, "What would outcomes have been for program beneficiaries, had they not participated in the program?" This is a difficult question to answer because farmers do not self-select into CAA at random.

For example, consider an evaluation strategy that compared outcomes between CAA members and non-members in a given village. Members may be more or less productive than their peers who remain outside the program – for example, those who join the program may have been more likely to use fertilizer or other inputs regardless – and any such differences can lead researchers using naïve evaluation strategies to confuse these *inherent* differences between member and non-member farmers from those that are *caused* joining CAA. This is the problem of *selection bias*.

Alternatively, consider an evaluation strategy that compared outcomes for CAA members before and after they join the association. This is commonly known as a *pre-post* design. The problem in this case is that there may be many other features of the economic and agronomic environment that change over this same period of time. Prices for output and inputs, rains, and other growing conditions may get better or worse over the same period, but an evaluation based on a simple before/after comparison would mistakenly attribute the *combined* effect of all of these environmental changes to the effect of the program alone. We will refer to this as the bias of *environmental changes* in evaluation.

Our survey has used administrative data provided by CAA to develop a novel sampling design that overcomes these problems under minimal assumptions. The intuition for this design is as follows. Suppose that we want to understand what the impact of joining CAA was on the production of those who became members in 2007/08. The problem of environmental change means that we cannot simply compare their 2006/07 output with their 2007/08 output, while the problem of selection bias implies that we cannot simply compare individuals who were members in 2007/08 with a representative sample of those who were not in the program (but were otherwise comparable, e.g, because they were from the same village).

However, by the time of the GCFS survey, which was conducted in September of 2008, CAA membership decisions had already been made for the 2008/09 cocoa season. Access to CAA administrative data meant that we could interview a representative sample of those who joined the program in 2008, and ask them about their *pre-program* (2007/08) cocoa output. Then a comparison between those who were members in 2007/08 and those who subsequently joined the program in 2008/09 forms the basis of the evaluation. From the perspective of the survey, we may think of this as a comparison between *current* and *future* members of the program. Because the comparison is made between individual farmers at the same point in time – all comparisons are based on 2007/08 production – it solves the problem of environmental change: prices and basic weather conditions are the same for current and future members. And because all of the individuals who form the basis of this comparison have joined the program, any systematic differences between those who take the initiative to join, and are able to form groups in order to do so, and those who do not or cannot, are already taken into account. This addresses the issue of selection bias.[1]

Sample villages were drawn from five regions in which CAA has operated: Ashanti, Brong Ahafo, Central, Eastern, and Western.

Two further issues must be dealt with in the design of the evaluation strategy.

[1] More precisely, the issue of selection bias that occurs because members and non-members within a given village would look different in the absence of the program can be resolved under the assumption that the group formation process happens in the same way in both 2007/08 and in 2008/09.

There is also another potential source of selection bias, which would occur if villages visited for the first time in 2007/08 were more productive on average than villages visited in 2008/09. We return to this issue below.

First, one minor complicating factor is the possibility that those who join CAA in the first year that it is offered in their village may be different from those who join CAA only in the second or third year of its availability – that is, after they have had an opportunity to observe the results of their friends and neighbours.

Our strategy for addressing this problem is simple. We focus on estimating the effect of the first year of CAA membership, and we do so by comparing:

- individuals who joined in the first year that CAA visited their village[2] - and who happened to live in a village where CAA promoters first started signing up farmers in 2007/08; with
- individuals who joined in the first year that CAA visited their village, but who happened to live in a village in which CAA promoters did not work until 2008/09.

Thus we restrict attention to "early joiners" in order to ensure that we compare like with like. We have employed a similar strategy for sampling villages first visited by CAA in 2006/07, which is of course the first year of the Association's work in Ghana. Finally, in villages that were first visited in each of these years, we sample not only the early joiners but also collect a representative sample of those who did not join the program. The results of this sampling exercise, drawing early joiners and non-members from villages first visited in each of the three years of CAA's existence, are presented in Table 1.

Table 1. Sample design

| | | Decision to join in year of first CAA visit | | |
|---|---|---|---|---|
| | | Member | Non-member | Total |
| Year of first visit by CAA | 2006/07 | 49 | 46 | 95 |
| | 2007/08 | 66 | 39 | 105 |
| | 2008/09 | 92 | 44 | 136 |
| | Total | 207 | 129 | 336 |

Second, the evaluation design must also address the concern that villages visited by the program are systematically different from one another. The potential problem is as follows: suppose that the villages first visited by CAA promoters in 2007/08 are more productive villages on average than those first visited by CAA promoters in 2008/09. If this is the case, then a comparison of

[2] Throughout, we refer to these geographic units as villages for expositional clarity. They correspond to what are called "locations" in CAA's administrative data, and in practical terms they sometimes encompass more than one village.

early joiners across these two types of villages is misleading: they differ not only because the 2008/09 villages did not have access to CAA inputs for the year under study (2007/08), but *also* because they would have been less productive *even if neither village had ever received access to CAA*.

To address this, we adopt an approach that is valid even if this variation of selection bias is present. In brief, this amounts to using a kind of difference-in-differences (DiD) evaluation strategy. Rather than simply compare the levels of output among members in villages that have received access to the program and those that have not at the time of our survey (a *difference in means* strategy), we can compare the difference in output between members and non-members in villages that have received access to the program with the difference in output between members and non-members in villages that have not yet received this access. In effect, we use the non-members in the two types of villages to control for unobserved characteristics of the village that might affect levels of production there in the absence of the program. Further details of this strategy are given in the companion paper (CITE) and in Section 3, where we put forward the empirical model used to estimate program impacts. In the remainder of this Section, we describe the characteristics of sampled individuals according to the sample frame presented in Table 1.[3]

## 2.2 Household Characteristics

Demographic characteristics of the population sample presented in Table 2 are revealing. Average household size for members and non members was higher in 2007/08 than the previous 2006/07 season. In 2006/07 however, members had higher mean HH members than non members. A household member is defined here as anyone above 15 and lives in the household who worked on the respondent's cocoa farm(s). The results indicate that members of Abrabopa Association used more household labour relative to non members (see Table 6).

Table 2 also presents the percentage of sampled farmers that were female in the member and non-member populations of villages first reached by CAA in each of the three years. CAA members are slightly less likely to be female than in the at-large population of farmers, but these differences are slight and are statistically insignificant. It is notable that the recovery in female participation rates from 2007/08 to 2008/09 is borne out in CAA's administrative data as well; these data show a rise from approximately 15% to 24% in the membership across these latter two

[3] This strategy is complicated by the possibility that there are externalities affecting the output of non-members in villages where some individuals have joined CAA. We note, however, that any positive externalities would lead us to *underestimate* the true impacts of the program. Estimates discussed in the following sections are already quite substantial.

years. Thus the gender distribution of participation in CAA is broadly reflective of the cocoa-farming population as a whole, and this does not show signs of decline.

As shown in Table 2 and in Figure 1, average ages of CAA members are typical of the farming population in their villages, and show no secular trend over time.

The education variable suggests that, in the first two years of the program, those who joined in the first year of a CAA promoter's arrival in the village tended to be more educated than farmers from that village on average. This relationship declined in the 2008/09 season, where the pattern was reversed, with member farmers significantly less educated than they had been in the 2007/08 season. The evolution of this pattern may reflect growing awareness of the program in general.

**Table 2. Household characteristics by CAA membership status**

| | | non-members | | members | |
|---|---|---|---|---|---|
| year of first CAA visit | characteristic | mean | st. dev. | mean | st. dev. |
| 2006/07 | adult household members | 2.88 | (1.34) | 3.33 | (1.59) |
| | gender | 0.30 | (0.46) | 0.24 | (0.43) |
| | age | 50.68 | (12.51) | 49.31 | (12.88) |
| | JSS+ | 0.45 | (0.50) | 0.55 | (0.50) |
| 2007/08 | adult household members | 2.81 | (1.70) | 3.14 | (1.29) |
| | gender | 0.26 | (0.44) | 0.15 | (0.36) |
| | age | 50.58 | (14.01) | 49.48 | (12.68) |
| | JSS+ | 0.48 | (0.51) | 0.74 | (0.44) |
| 2008/09 | adult household members | 2.68 | (1.40) | 2.58 | (1.25) |
| | gender | 0.24 | (0.43) | 0.21 | (0.41) |
| | age | 47.30 | (10.21) | 48.43 | (13.66) |
| | JSS+ | 0.62 | (0.49) | 0.54 | (0.50) |

**Figure 2: Distribution of Household Members**

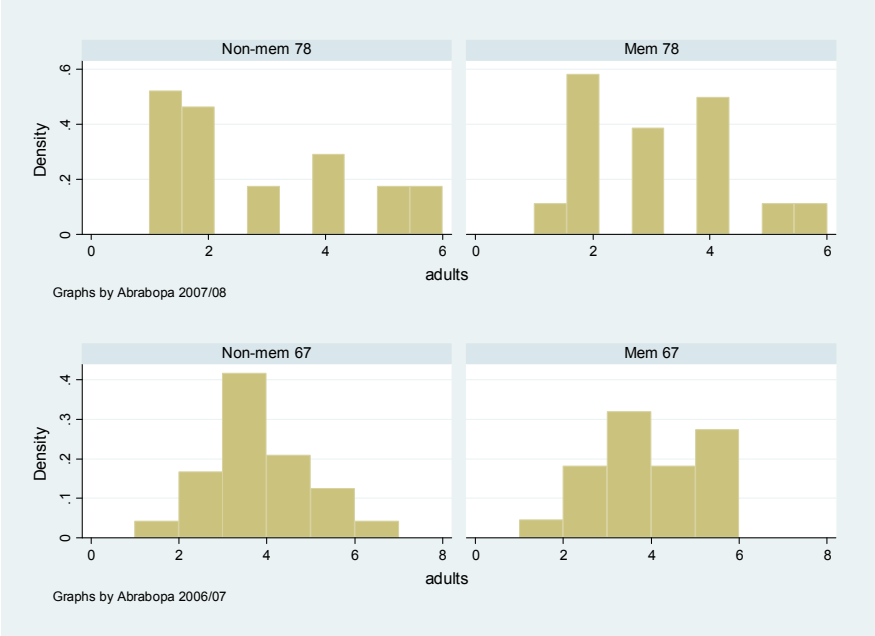
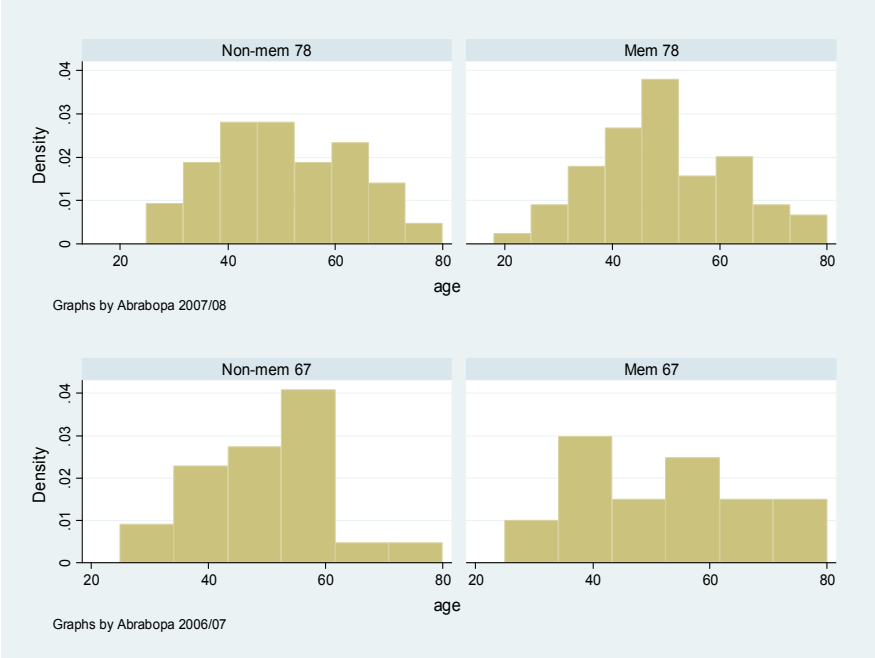
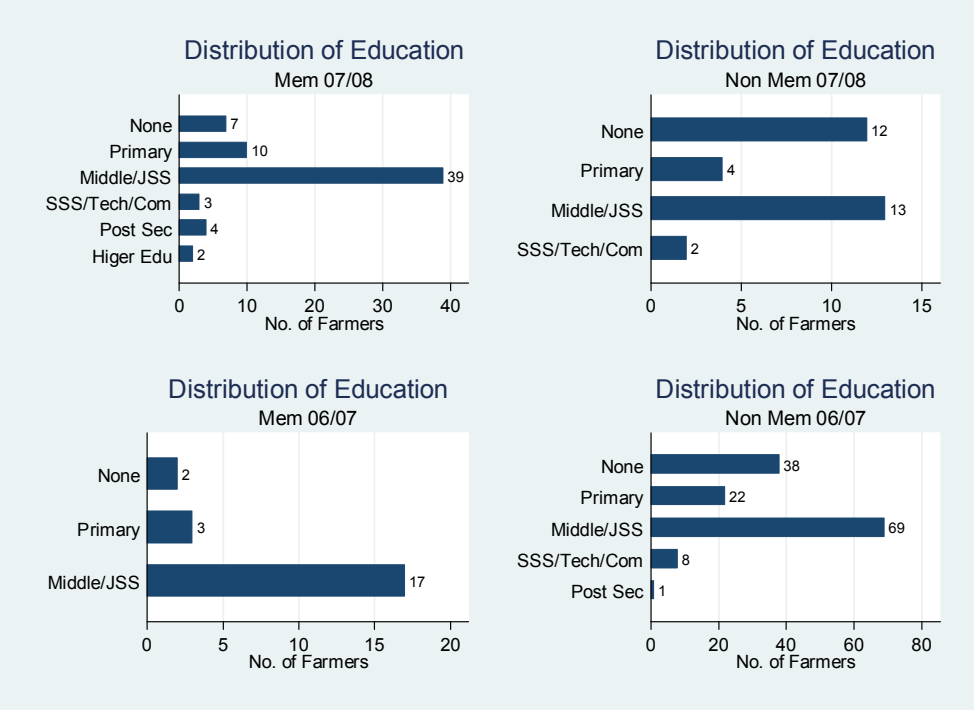



**Figure 1. Ages of member and non-member farmers, by year of CAA arrival in village**




The age distribution across members and non members suggest a fairly normal representation in the 2007/08 season for members and non members relative to the 06/07 season. It also suggests the inclusion of younger farmers in the credit scheme. For the membership graph for 07/08 farmers younger than 20 and probably more than 18 were active members

**Figure 5: Educational Levels**




The average level of education is higher for the members of cocoa Abrabopa Association than non-members. This was higher in 07/08 cocoa season than the 06/07 season. The degree of dispersion is also wider for 2007/08 than 2006/07 and than for non members.

## 2.3 Labour Input Usage

Like most developing countries, agriculture in Ghana is labour intensive. The amount of labour input has direct relationship with land productivity. On cocoa farms, we set a distinction among four major types of labour: household labour, annual labour (e.g., *abunu, abusua*, or caretaker labourers of other forms), contract labour (e.g., that hired on casual basis, by day or by task), and *nnoboa* labour. Cocoa Abrabopa recommends, as part of cost minimization strategy, the use of household and *nnoboa* labour, and specifically encourages members to share labour on a *nnoboa* basis within their groups.

Table 3 provides statistics on the components of labour input used by member farmers on cocoa farms during the 2007/08 cocoa season. As with household characteristics, in this table farmers in the sample are grouped according to two dimensions. First, villages in the sample are classified on the basis of the year in which CAA first began to register members in that location. In our sample, this is 2006/07, 2007/08, or 2008/09. Second, farmers within those villages are classified according to their decision *in that first year* to join or to remain out of CAA. Thus comparison, for example, of the 2007/08 "members" with the 2008/09 "members" provides an indication of the impacts of the program on labour use, since input use among the future members of 2008/09 villages is measured prior to their entry into the program.

Such a comparison of members before exposure to CAA (the 2008/09 members) and after exposure to CAA (the 2007/08 members) suggests increases in both household and *nnoboa*

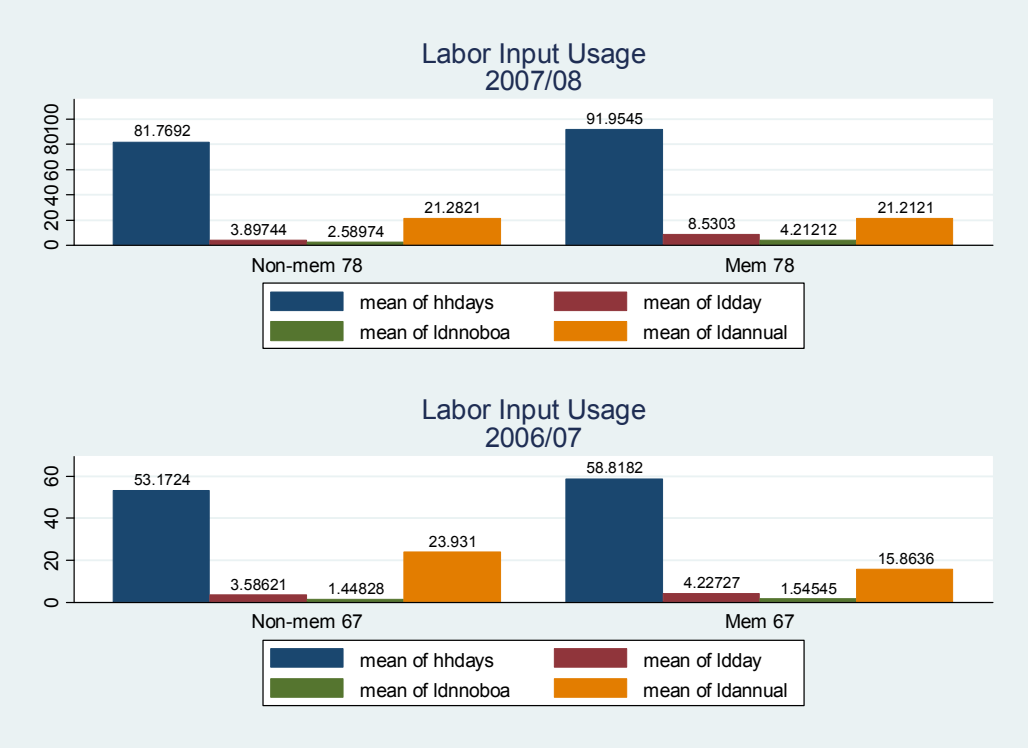
labour in response to the program: from a mean of 67 household and 2.5 *nnoboa* labour days to means of 92 and 4.2, respectively.

**Table 3. Labour inputs in 2007/08 season**

| | | non-members | | | members | | |
|---|---|---|---|---|---|---|---|
| year of first CAA visit | characteristic | mean | median | st. dev. | mean | median | st. dev. |
| 2006/07 | household labour | 63.46 | 28.5 | (75.84) | 68.96 | 41 | (71.77) |
| | annual labour | 16.78 | 0 | (49.61) | 14.33 | 0 | (30.43) |
| | contract labour | 9.80 | 1.5 | (17.97) | 7.08 | 0 | (14.22) |
| | nnoboa labour | 1.70 | 0 | (03.86) | 2.10 | 0 | (03.74) |
| 2007/08 | household labour | 81.77 | 52 | (96.01) | 91.95 | 71 | (89.08) |
| | annual labour | 21.28 | 0 | (53.88) | 21.21 | 0 | (47.46) |
| | contract labour | 7.95 | 0 | (18.69) | 13.83 | 5 | (20.96) |
| | nnoboa labour | 2.59 | 0 | (07.80) | 4.21 | 0 | (07.77) |
| 2008/09 | household labour | 50.05 | 25 | (60.72) | 67.18 | 26.5 | (83.28) |
| | annual labour | 21.25 | 0 | (51.68) | 30.27 | 0 | (61.73) |
| | contract labour | 9.45 | 0 | (15.55) | 9.07 | 4 | (18.10) |
| | nnoboa labour | 0.91 | 0 | (02.31) | 2.53 | 0 | (06.09) |

Two caveats are required in relation to this apparent increase in labour use. First, while the evidence suggests an increase in various forms of labour input, it is notable that more than 50% of farmers still report that they used *no nnoboa* labour in the 2007/08 season, even among CAA members. Second, given higher labour use even among non-members in the 2007/08 villages, we cannot rule out the possibility that these differences are attributable to differences in labour-market or other conditions across villages. A village-fixed-effects regression that explicitly allows for this possibility fails to reject the hypothesis that there has been no impact on labour use. It is also possible, however, that the high levels of labour use among non-members in the 2007/08 villages reflect a positive externality of the program, in which case such a fixed effects approach would tend to understate CAA impacts.

**Figure 2. Distribution of labour inputs**




We observe no significant difference in the distribution of input usage between 06/07 and 07/08 cocoa seasons. Similar distribution is also observed across members and non-members. Significant usage of household labor is observed the use of Nnoboa grew significantly across the groups.

## *2.4 Non Labour Input Usage*

Non-labour inputs are required in optimal quantities to achieve desirable productivity. In the last couple of years, efforts to improve soil fertility and manage disease and pests have stepped up in Ghana's cocoa sub-sector. Farmers are encouraged through education to apply fertilizers, insecticides and fungicides to improve their farms ability to bearing more fruit and control the most common pests and diseases.

This emerging development suggests farmers are responding to official calls to apply fertilizers and other inputs. The challenge, however, lies in ensuring the right amounts are applied at correct periods of the season. Extensive education on inputs application methods and issues of environmental management are crucial for sustainable increases in productivity.

CAA has among its chief aims the goal of increasing farmers' usage of such non-labour inputs. Table 4 documents the rise in non-labour input use according to CAA membership status. The relevant comparison for understanding the impacts of CAA on input use in the first year is again a comparison between members in villages first visited by CAA in 2007/08 and members in villages first visited by CAA in 2008/09. Since all quantities refer to input usage in the 2007/08

season, then as discussed in Section 2.1, this comparison between 'current' and 'future' CAA members resolves the problem of selection bias.

Of CAA farmers who joined in 2007/08, 98% report using fertilizer, with 100% and 85% reporting use of insecticide and fungicide, respectively. These compare with usage rates of 32, 95, and 42% for fertilizer, insecticide and fungicide among those who go on to become CAA members for the first time in 2008/09. Accordingly, we see a rise in mean fertilizer quantities from 2.87 to 8.18 bags on the farmers *entire area* under cocoa cultivation: this suggests (a) that member farmers are purchasing some fertilizer even before joining the program, and (b) that spot-market purchases of fertilizer decline slightly in response to the program. These reductions in spot-market purchases may be used in part to fund increased use of other inputs, such as contract labour.

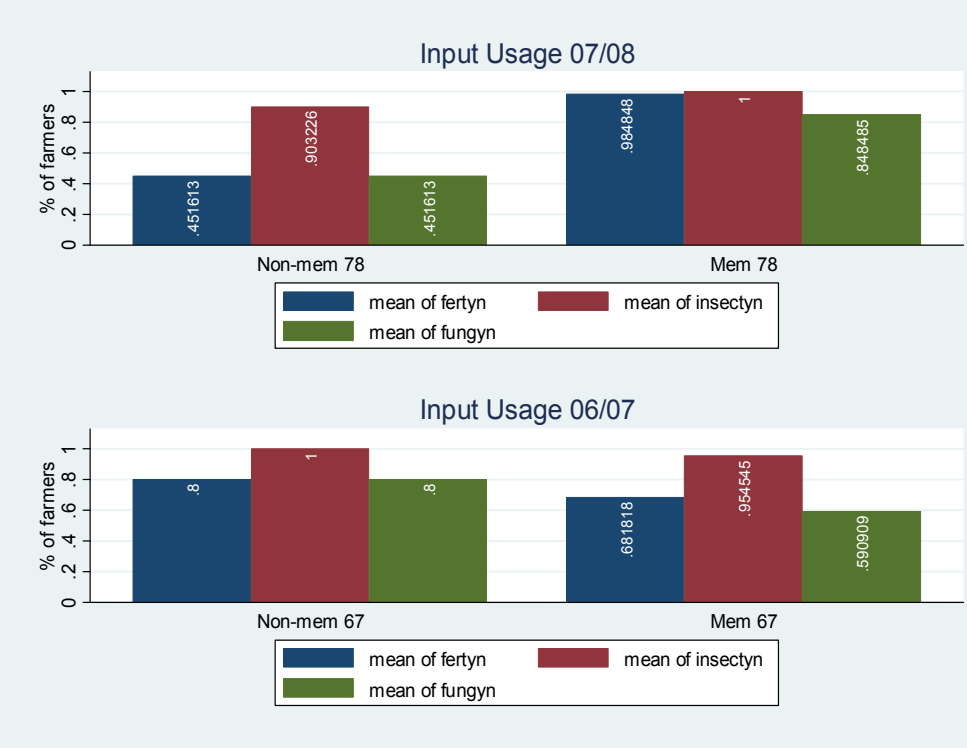
It is also notable that fertilizer use among non-members in villages first visited by CAA in 2007/08 and 2006/07 is higher than fertilizer use among non-members in villages first visited by CAA in 2008/09. We cannot distinguish between two potential explanations for this. First, it is possible that this reflects something about the village selection process: it may be that villages that were visited earlier tended to be using fertilizer. Alternatively, this may be viewed as a *positive externality* of the program: if CAA members' use of fertilizer has demonstration effects that influence their peers to do the same, this may increase the use of fertilizer among non-members in the same village. If the latter is true, then the private benefits of CAA to its membership will tend to understate the returns to the sector as a whole.[4]

[4] It should also be noted that the fixed-effects estimates of CAA impacts, presented in Section 3 will be biased *downward* in this case – they will tend to understate the impact of CAA membership on production.

**Table 4. Non-labour inputs in 2007/08 season**

| year of first CAA visit | input | non-members | | | | members | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | % use any | mean | median | st. dev. | % use any | mean | median | st. dev. |
| 2006/07 | fertilizer, 50 kg bags | 0.51 | 3.93 | 2 | (04.78) | 0.41 | 4.71 | 0 | (08.83) |
| | insecticide, litres | 0.98 | 8.08 | 4 | (11.04) | 0.88 | 5.17 | 2.5 | (06.48) |
| | fungicide, sachets | 0.56 | 68.27 | 53.5 | (49.82) | 0.57 | 85.04 | 65 | (80.87) |
| 2007/08 | fertilizer, 50 kg bags | 0.45 | 4.71 | 0 | (09.05) | 0.98 | 8.18 | 6 | (07.04) |
| | insecticide, litres | 0.90 | 7.84 | 3.5 | (09.80) | 1.00 | 6.53 | 4.8 | (05.17) |
| | fungicide, sachets | 0.45 | 39.54 | 20 | (52.28) | 0.85 | 93.11 | 96 | (58.29) |
| 2008/09 | fertilizer, 50 kg bags | 0.17 | 1.94 | 0 | (05.29) | 0.32 | 2.87 | 0 | (05.21) |
| | insecticide, litres | 0.89 | 4.28 | 4 | (03.78) | 0.95 | 4.84 | 4 | (03.51) |
| | fungicide, sachets | 0.31 | 66.18 | 50 | (47.84) | 0.42 | 90.89 | 55 | (93.56) |

**Figure 3. Non-labour inputs in 2007/08, by CAA membership status**




Similar distribution of inputs usage is observed for non members over the two seasons but marginal declines are also observed in the percentage of farms using these inputs. This raises sustainability issues relating to ability of farmers to raise sufficient funds towards purchases of these inputs. On the contrary improvements are observed in the use of all inputs by Abrabopa farmers.

## 2.5 Output, yield and farm sizes

National average productivity was estimated at about 400kg/ha for the 2007/08 season (FAOSTAT 2009). This is substantially lower than yields of 765kg/ha in Cote d'Ivoire (FAOSTAT 2009) or on experimental plots in Ghana itself, where yields in excess of 2500kg/ha have been achieved (Cocoa Research Institute 1973). Policy interventions and private-sector actors such as the CAA are therefore of great interest if they are able to bring about increases in productivity. While a formal, econometric analysis of the impacts of CAA will be undertaken in Section 3, below we provide a description of these outcome data upon which the econometric results are based.

Table 5 summarizes outputs, yields, and total farm sizes according to CAA membership status. We focus attention on output in levels, noting that CAA provides a fixed quantity of inputs to all of its (first-year) members, irrespective of the total amount of land that cultivated to cocoa. While our survey data do not at this point allow us to isolate output on the 2 acres nominated for application of CAA inputs, we are of the view that this is *not* the best way to understand the program's full impacts.

Consider for example the possibility that farmers – who we know buy some fertilizer even in the absence of CAA loans – shift their spot-market fertilizer to other parcels on their farm in response to CAA membership. In this case, output on *other, non-Abrabopa* parts of the farm would increase, and this increase is directly attributable to the impact of the program. Because both CAA inputs and also other (e.g., labour inputs) may be shifted across the total farmland in response to program membership, an evaluation approach that looks at outcomes on the farmer's *entire* cocoa land is required.

From Table 5 we see that farmers who joined CAA in 2008/09 had comparable total output levels (1,473 kg) to those who lived in the same villages but did not join the program (1,419 kg). However, these future members of the program achieved such yields on smaller farms on average, resulting in higher yields.

**Table 5. Output, yield, and farm size, 2007/08, by CAA membership status**

| year of first CAA visit | characteristic | non-members mean | non-members median | non-members st. dev. | members mean | members median | members st. dev. |
|---|---|---|---|---|---|---|---|
| 2006/07 | output, kg | 989.09 | 750.00 | (727.20) | 1,270.70 | 750.00 | (1387.29) |
| | yield, kg/ha | 369.08 | 267.30 | (341.58) | 474.01 | 347.48 | (378.41) |
| | total farm size, ha | 4.14 | 2.59 | (4.94) | 3.10 | 2.23 | (2.94) |
| 2007/08 | output, kg | 1,592.07 | 625.00 | (2265.61) | 1,907.28 | 1,348.75 | (2010.50) |
| | yield, kg/ha | 374.78 | 246.13 | (344.18) | 538.77 | 463.31 | (435.66) |
| | total farm size, ha | 6.80 | 2.79 | (11.81) | 4.47 | 3.24 | (04.01) |
| 2008/09 | output, kg | 1,419.40 | 1,000.00 | (1364.11) | 1,472.67 | 937.50 | (1795.11) |
| | yield, kg/ha | 528.42 | 314.43 | (892.62) | 493.99 | 342.34 | (434.69) |
| | total farm size, ha | 4.12 | 3.24 | (4.13) | 3.28 | 2.53 | (2.24) |

# 3 Evaluation of program impacts

In this Section, we undertake a formal evaluation of the impacts of CAA membership on farmer production and incomes. To do so, we first discuss two methods by which we can identify the effects of the program in Section 3.1. .

## *3.1 Identifying the Impact of the Program*

The following Table shows our options for estimating the effects of the program.

| | Group | Member | CAA Program in Place | Farmer Given Inputs which affected Output |
|---|---|---|---|---|
| Village offered Abrabopa Membership First in 2008/09 | 1 | No | No | No |
| | 2 | Yes | No | No |
| Village offered Abrabopa Membership First in 2007/08 | 3 | No | Yes | No |
| | 4 | Yes | Yes | Yes |

At the time of the survey in October 2008 for the crop year 2007/08 we can divide our sample into four groups based on when they were offered membership of Akrabopa and whether or not they decided to join. For those offered membership in 2008/09 some chose not to join (group 1) and some chose to join (group 2). As at the time if the survey neither group had received inputs from the program so for both groups the farmer's output was NOT affected by the program. For

those offered membership in 2007 similarly some chose not to join (group 3) and some did join (group 4). It is this fourth group that received the inputs from the CAA program and whose output would have been affected by it for the 2007/08 season.

The output from these four groups for the 2007/08 season is given in Figure 4.

**Figure 4. Total cocoa output, 2007/08, by CAA membership status and year of first visit to village**


## 3.2 CAA impacts, mechanisms and returns

To understand constraints to growth in Ghana's cocoa sector, we set out in this section to establish the agronomic and economic impact of the CAA program. Our analysis proceeds in three steps. First, we estimate the impact of CAA participation on cocoa output. Second, we identify changes in inputs – both those provided by the program and those purchased or

otherwise provided by farmers. CAA loans are shown to partially crowd out free-market purchases of fertilizer, but to crowd *in* the purchase of casual farm labor. These increases in wage employment are consistent with at least two mechanisms: a relaxation of farmers' liquidity constraints, or an increase in the returns to wage labor. Third, we put together the information from these two estimates to provide an assessment of the rate of return to participation in the program.

### 3.2.1 Production impacts

There are two ways of looking at the effects of the program given the four groups whose output is summarized in Figure 4. In the first we simply compare the outputs of Group 4 with that of Group 2.

Effect of program (1) = (Group 4 - Group 2)

What this comparison does is to ask: given that you chose to join a group what was the difference in output? We thus confine the comparison to group members and exploit the fact that those who joined in 2009/09 have not yet benefited from the program inputs. This has the advantage that we do not need to worry about whether joining the group is a source of differences in outcomes (providing we are willing to assume the factors that determine group membership have not changed over time). Why is confining the sample to those who are group members important? The answer is that there may be important differences between members and non-members which affect their levels of output. For example if we chose to compare Group 4 with Group 3, i.e. those whose output was changed by the program with those who chose not to join in 2007/08, we would combine the effects of group membership with the effects of the program. It is possible that if more productive farers choose to join a group then the differences we observe been Groups 4 and 3 are NOT due to the program but due to the differences between members and non-members of groups.

While confining the comparison to farmers who are group members addresses the problem that those who join a group may differ from those who do not it requires us to assume that there is no correlation between the villages in which the program is being made available and the productivity of farmers in that village. If the program chose relatively productive villages to begin with then the increase in output we see is not due to the program it is due to the choice of village.

We make an allowance for this problem by our second method of estimating the effects of the program. We begin by comparing Groups 4 and 3, i.e. those whose output was changed by the program with those who chose not to join in 2007/08, but from this estimate we subtract the

differences in output between Groups 2 and 1. What does this adjustment do? If we compare the output of Group 2 with the output of Group 1 that provides us with an estimate of the effects of group membership, ie the only difference between those two groups is that some choose to join and some choose not to. Again we need to assume that the factors that induced people to join are constant over time but with that assumption we can get our second estimate of the effects of the program by the following calculation:

Effect of program (2) = (Group 4 - Group 3) - (Group 2 - Group 1).

There is a big advantage to this second method. As it combines both member and non-members in villages we can now allow for the possibility that village effects matter.

The productive impacts of the program are estimated in Table 6. These are of interest not only as an input into the cost-benefit analysis, but also because the low productivity of the sector and limited successes in bringing about yeild gains by similar mechanisms leave open the question of whether such intensive improvements in productivity can be brought about at *any* cost.

We estimate program impacts on levels of cocoa production, because the program offers loans equivalent to two acres worth of inputs. If applied directly and without externalities for the remainder of the farmers' land, this would result in the same increment in output regardless of farmers' outputs in the absence of the program. Farmers with larger farms would be expected to observe a smaller percentage increase in output as a consequence of program membership.[5]

In Table 7 column (1) we present the first of our estimates ie we confine the comparison to those who were members of Akbabopa. This yields a point estimate of 435 kg. Measured against the average output for that year of 1473 kg among the comparison group (those who joined the program only subsequently, in 2008/09), this represents a gross increase in output of approximately 30%.

For reasons given in the previous section, we may be concerned that these results are driven by the selection of higher yielding villages for inclusion in earlier waves of the program. To address this in column (2) we present the result of our second estimation procedure.

[5] In separate work (not shown), we test for heterogeneous treatment effects by farm size using the estimation framework above. We fail to reject the null hypothesis of equal impacts on farmers of all sizes.

**Table 6. Impacts of CAA membership on cocoa output**

| | (1) | (2) | (3) |
|---|---|---|---|
| Joined 2007/08 | 421.83 | 542.02** | 630.98** |
| | (516.46) | (210.52) | (219.28) |
| Joined 2008/09 | | -103.24 | -135.24 |
| | | (296.60) | (307.19) |
| Obs. | 157 | 225 | 225 |
| p1 | .411 | .064 | .072 |
| p2 | | | .425 |

Notes: Dependent variable is cocoa output (kg) in 2007/08. Column (1) presents estimates of identification strategy 1. Columns (2) and (3) use identification strategy 2, with random and fixed effects, respectively. P1 gives p-value of F test of hypothesis that ATT = 0. P2 gives p-value of a test of the fixed effects versus random effects specification (under the null hypothesis of random effects), as suggested by Arellano (1993) [3]; following implementation in Schaffer and Stillman (2006) [4]. Heteroskedasticity robust standard errors reported, allowing arbitrary correlation within villages.

In column (3) of Table 6, we allow for village-level fixed effects. These estimates are therefore robust to the challenge that the village sequence may be correlated with productivity. The point estimate of the program impact on 2007/08 output is 641.5 + 100.6 = 742 kg. An *F*-test rejects the hypothesis that this estimated impact is equal to zero at the 10 percent level.

If the sequence by which villages are offered treatment is in fact uncorrelated with their potential output in the absence of the program, but if there are unobservable factors affecting output that are common within villages, then a random-effects estimate that uses information from the non-members as well as the members in both current and future treated villages will be more efficient than the OLS results on the current and future members alone. We estimate such a random-effects specification in column (2). This gives a point estimate of an impact of 562.6 + 75.9 = 638.5 kg. Again, we reject the null hypothesis of no impact at the 10 percent level.

It is worth considering the likely bias due to productive spillovers. We may be concerned that insecticide and fungicide have some spillover effects upon non-members in the village, or that learning or economies of scale in transportation will increase the usage or efficiency of inputs by non-members in program villages. All of these possibilities would tend to increase the output of non-members in program villages. Consequently, the double-difference estimation strategies that compare members and non-members within program villages, and then compare these differences to the same difference in future program villages, would tend to *understate* program impacts.

### 3.2.2 Mechanisms and cost-benefit implications

The estimated program impact of 638.5 kg equates to a 43% increase in revenue for the population of program members. At face value, this appears to be a high return: farmers typically received 75 New Ghana Cedis for each 62.5 kg bag of cocoa that they sold, so that the estimated

increase in gross income would equate to approximately GHS 766. If indeed there were no additional costs invoked, this would represent nearly a threefold return on the loan of GHS 277.

However, it is possible that farmers increase (or decrease) their use of other inputs on the farm in response to access to CAA loans. These changes in behaviour may be partly responsible for the output gains achieved under the program. The implied increase in costs created by these changes should also be taken into account in measuring the private return to program participation.

Estimated treatment effects on demand for a set of inputs where data are available are presented in column (2) of Table 7. The table reports both the estimated treatment effect and the associated p-value from an F-test of the hypothesis that this difference is equal to zero. As expected, we find large impacts on fertilizer use, although we can only reject the null of no impact for the quantity of fertilizer used (it should be noted that other inputs are typically reported less accurately in the survey data, so this may be a problem of measurement error rather than the absence of impacts). But while the program allocates 6 bags of fertilizer to farmers, average fertilizer use rises by only 5. Since farmers were purchasing some fertilizer in cash on the market in the absence of the program – those who joined in 2008/09 purchased an average of 2.87 bags of fertilizer in the year before the program came to their villages – this suggests that farmers cut back on their cash purchases of fertilizer in response to the inputs given on credit.

By reducing their cash purchases of inputs, the program alleviates liquidity constraints for farmers. They may spend this additional money on the purchasing of other (labor or non-labor) inputs. Of course the money may be used in other ways, such as to finance consumption or other income-generating activities; we do not observe these in the current survey. It may also be the case that the *returns* to other factors increase if they are complementary to the inputs provided by CAA.

To investigate these effects on complementary inputs, we estimate input demands for a range of inputs used in the production process but not provided by the program. As reported in Table 7, we find a significant effect on two types of labor. We see a statistically significant increase in the number of daily wage laborers, and an increase in the number of *nnoboa* laborers, employed on members' farms.[6]

[6] *Nnoboa* is a labor-sharing arrangement common in this part of Ghana. CAA explicitly encourages the use of *nnoboa* shared labor among program members. Note that there are a variety of other labor contracts available; we see no significant impacts on the use of annual laborers (including sharecroppers), or in the use of "by task" hired laborers, who are most often hired for such tasks as weeding.

**Table 7. Estimated impacts of CAA membership on input use**

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| fertilizer, 50 kg bags | 5.31 | 5 | 3.98 | 0.9 |
| | (0.00) | (0.00) | (0.03) | (0.64) |
| insecticide, litres | 1.7 | 0.98 | -1.21 | 1.84 |
| | (0.09) | (0.27) | (0.61) | (0.40) |
| fungicide, sachets | 2.21 | 3.65 | 40.6 | 8.02 |
| | (0.88) | (0.81) | (0.00) | (0.02) |
| number annual employed | -0.01 | 0.03 | 0.05 | 12.21 |
| | (0.98) | (0.91) | (0.89) | (0.00) |
| number contract "by day" employed | 1.39 | 1.26 | 0.48 | 3.77 |
| | (0.03) | (0.01) | (0.60) | (0.15) |
| number contract "by task" employed | 0.15 | 0.1 | 0 | 4.92 |
| | (0.70) | (0.76) | (1.00) | (0.09) |
| number *nnoboa* employed | 2.48 | 4.81 | 7.17 | 3.62 |
| | (0.33) | (0.02) | (0.00) | (0.16) |
| household labourers | 0.54 | 0.65 | 1.04 | 0.71 |
| | (0.24) | (0.15) | (0.17) | (0.70) |
| ln cocoa farm size, ha. | 0.21 | 0.25 | 0.26 | 0.17 |
| | (0.32) | (0.23) | (0.48) | (0.92) |

Notes: Columns 1, 2, and 3 report estimated factor demand effects for each input according to the estimation strategies of Table 6. P-values for a Wald test of zero impact on factor demand in parentheses of columns 1-3. Column 4 reports Wald test statistic and p-value for Arellano's (1993) [3] generalization of the Hausman test for fixed versus random effects. Test statistics based on heteroskedasticity-robust standard errors, clustered at village level.

A full assessment of CAA program impacts requires us to cost these additional inputs. Program farmers reduce their autonomous consumption of fertilizer by 1 bag, valued at GHC 15. The typical daily laborer is paid GHS 3/day and works 3.5 days, so that the cost of increasing daily laborers by 1.26 is approximately GHS 13. *Nnoboa* laborers work a half day on average in our sample. We cost their labor at the daily wage rate, taking this to be the opportunity cost of household labor and noting that household members are obliged under the *nnoboa* system to provide the same amount of labor to those who have worked on their farm as is provided to them. The increased cost from the *nnoboa* system is only approximately GHS 6. These figures are not sufficient to substantially alter the cost-benefit implications of the program.

# 4 Sustainability of Cocoa Abrabopa Association (CAA)

The ultimate objective of the Cocoa Abrabopa Association is to increase membership strength to 50,000. This will be an arduous task as repayment has been a major challenge and a threat to the survival of Cocoa Abrabopa Association. In the 2007 evaluation by Cocobod, an estimated 17% of the members could not meet repayment deadline. This category of members lost their membership of the Association with the elapse of repayment deadline on 31st December 2007. The 2008 evaluation revealed similarly high attrition rate, as will be discussed below. But we also note an interesting phenomenon: dropout from CAA membership is not limited to those who experienced problems repaying their loans. We suggest an explanation below – namely, that farmers in the first year or years of their membership are uncertain about the profitability of this decision, and they take bad harvests as a signal that these returns are low. This suggests scope for further interventions using targeted information to improve program retention, an idea that will be taken up in greater detail in Section 5.

While Cocoa Abrabopa may be successful in raising output, the long-run viability of this private sector model depends on achieving high repayment. One argument for group lending is that it allows members to monitor and enforce their peers' repayment. But this depends on both the ability to monitor and social connections that help to enforce 'good' behaviour.

The argument for expulsion of shrewdness is acceptable as a measure for ensuring long-term viability of this model. Realistically, however, it is impracticable to distinguish the shrewd from genuine cases. Besides, both economic and social cost of rejoining becomes higher as the cycle of fertilizer application, for instance, is broken against scientific advice that optimal output can be realized after 3 years of continuous application.

Take the survival of a group to denote its repayment success. Summary statistics from CAA administrative data are presented in Table 8.[7] By matching group ID codes – and cross-checking these with the year of group foundation that is embedded in the group ID itself – we have traced the survival of CAA groups across years of the Association's operations. This exercise suggests that, in spite of loan recovery rates in excess of 90% [1], the dropout rate of groups has been rather large. Of the 163 groups that were formed in 2006, only 44 remained in the program in 2007. By 2008, 35 of these original groups remained, though it is interesting to note that 5 groups that were formed in 2006 and were *not* present in 2007 have re-entered CAA in 2008. Similarly, of the 724 CAA groups founded in 2007, only 427 remained in the 2008 season.

[7] These administrative data were kindly made available by CAA. They represent a near-census of CAA groups: data for two promoters could not be recovered and so are not included here.

**Table 8. Group formation and survival in CAA administrative data**

| | groups present in years | | |
|---|---|---|---|
| year of group foundation | 2006 | 2007 | 2008 |
| 2006 | 163 | 44 | 35 |
| 2007 | | 724 | 427 |
| 2008 | | | 643 |
| all | 163 | 768 | 1105 |

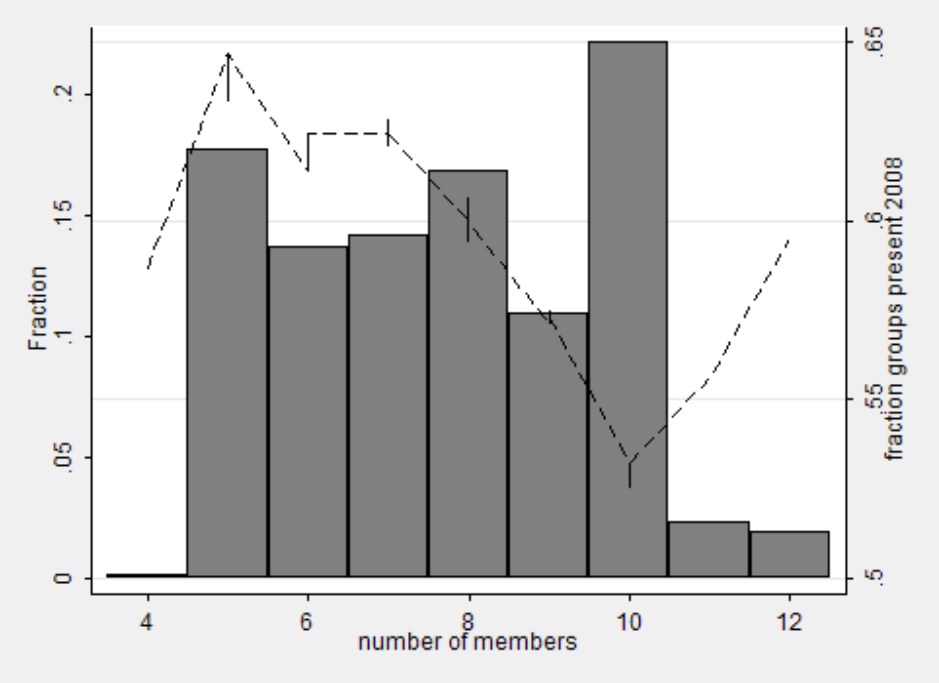
Source: CAA administrative data. Note that unit of observations are CAA groups.

It should be noted that these figures may overstate the drop-out rate at the individual level, however, since for example it is possible that some members of 2007 groups joined different groups or formed new groups in the 2008 season.

By using the codes embedded in individual ID numbers, two characteristics of groups can be extracted from CAA administrative data: the size and gender composition of groups. We examine how these characteristics of groups present in 2007 are correlated with the likelihood of the group remaining registered with CAA in 2008. In Figure 5 and Figure 6, respectively, we plot these characteristics against the probability of the group being retained in the CAA register.

A large caveat is required here. These two characteristics available in the administrative data may be correlated with many other factors. It may be the case, for example, that groups with more women or with fewer members come from less remote areas. One should *not* infer from the results that a change in the composition or size of groups would have a *causal* effect on repayment or retention of the sort reflected in the figures below.

**Figure 5. Group size and retention, 2007 - 2008**

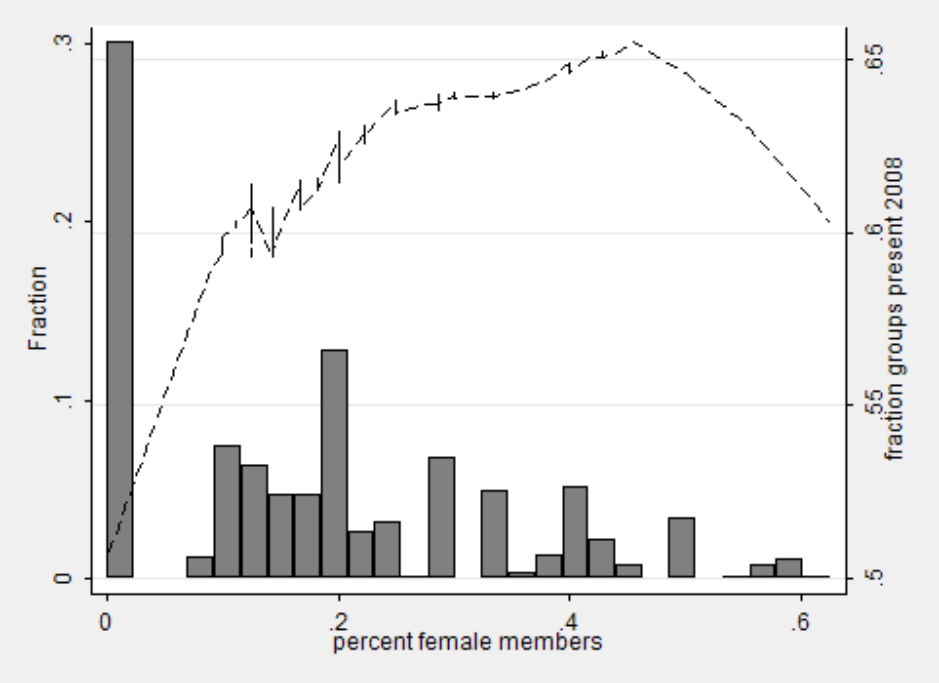



Source: CAA administrative data.

In Figure 5, the dashed line (and the scale at right) shows the relationship between group size in 2007 and the probability that a given group is observed in the subsequent (2008) season. The bars in the background show the distribution of group sizes: for example, the most common group size is 10, which accounts for nearly 25% of all groups (refer to scale at left). The figure shows a negative relationship between group size and retention: in the range of sizes from 5 – 10, smaller groups show significantly higher retention rates, with 65% of groups of size 5 re-appearing in the CAA program in 2008. It should be noted that, even if drop-out is driven entirely by late repayment, this does not necessarily imply that *individuals* in smaller groups are more likely to repay: since larger groups are clearly comprised of more individuals, they have in a sense more chances for at least one of these individuals to fail.

Figure 6 presents a similar exercise, undertaken with respect to the gender composition of groups. As illustrated there, we find that groups were most likely to remain in the program across the 2007 and 2008 seasons when they were equally balanced by gender. Groups with no female members – which constituted approximately 30% of all groups – had by far the lowest probability of remaining within the program.

**Figure 6. Gender composition and retention, 2007 - 2008**




Source: CAA administrative data.

While these results are highly suggestive, they should not be given a causal interpretation for reasons given above. Fundamentally, these two characteristics observed may be correlated with unobserved determinants of repayment. In that case our inference that group size or gender composition influences repayment outcomes is challenged by some other underlying factors. An understanding of the different financial constraints applying to men and women will help improve repayment performance.

The Cocoa Abrabopa Association has instituted alternate measures to readmit old members after redemption of outstanding debts in the next wave to minimize the impact of high attrition. This sounds quite reassuring but will this entice the old members who fell out by factors other than their own designs.

Turning to the GCFS data, we confirm the basic phenomenon of low program retention observed in Table 8. Given the high average return to CAA membership estimated in Section 3, it is striking that there is a 10% non-repayment rate and a drop-out rate of over 30% among those who were CAA members for the 2007/08 season in our sample. This is consistent with broader

patterns evident in CAA administrative data. Although CAA as a whole recovered 94% of its loans to farmers in that crop season, a sizeable number of farmers dropped out.[8]

Although our sample of 2007/08 members is relatively small, we can use data on their membership status as of 2008/09 to provide suggestive evidence as to the reasons for this low retention rate. We are interested in particular in whether heterogeneity in realized returns are responsible for observed drop-outs. We address this question in a discrete choice framework: we estimate a probit for the binary outcome of 2008/09 program membership on the subsample of 2007/08 members. These results are reported in Table 9. Here we use the changes in individual output from the 2006/07 to the 2007/08 season as a measure of returns to participation among those who joined CAA groups for the first time in 2007/08. We find that even when farmers were successful in repaying their loans (in which case they could remain in the program even if their peers were unsuccessful), those who experienced low returns were economically and statistically significantly less likely to remain within the program. The estimated coefficient on the change in log cocoa in column (3) implies that a one standard deviation increase in this measure of the return to CAA participation among the members (0.627 in our sample of 2007/08 members) corresponds to a 90% increase in the probability of remaining within the program.

**Table 9. Individual returns to CAA membership and program retention**

| | (1) | (2) | (3) |
|---|---|---|---|
| late or incomplete repayment | -2.4*** | -1.894*** | -1.522*** |
| | (0.522) | (0.519) | (0.486) |
| ln kg cocoa, 2007/08 | -0.384 | 1.064* | |
| | (0.200) | (0.615) | |
| ln kg cocoa, 2006/07 | | -1.341* | |
| | | (0.692) | |
| change in ln kg cocoa, 2006/07 - 2007/08 | | | 1.437* |
| | | | (0.778) |
| Obs. | 66 | 65 | 65 |

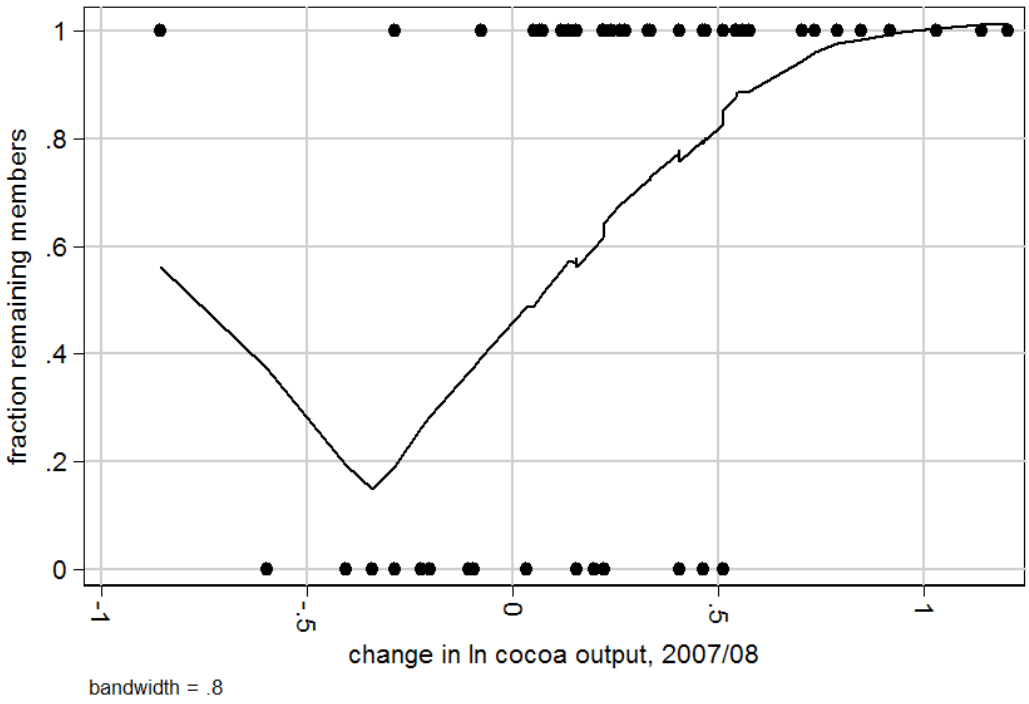
Probit marginal effects reported. Dependent variable equals one if respondent was a member of Abrabopa in 2008/09, zero otherwise. Sample consists of those who joined Abrabopa in 2007/08. Standard errors clustered at village level.

This relationship between is illustrated in Figure 7, which illustrates the (unconditional) relationship between the time-series changes in cocoa output of those who joined CAA in 2007/08 – our measure of returns at the individual level – and the likelihood of remaining

[8] Initial estimates based on a sample of administrative data suggest a drop-out rate in the population of CAA members that is comparable to that observed in our sample.

affiliated with a CAA group in 2008/09. We illustrate this relationship by plotting a lowess curve to this bivariate relationship. The evidence is strongly suggestive of a relationship between apparent shocks to farmers' output and program retention. Only three farmers who experienced a negative change in cocoa output following joining of the program stayed in the program, while no farmer who experienced a rise in log cocoa output of more than 0.5 dropped out.

**Figure 7. Returns to CAA membership and program retention**




Given the small sample size, it is important to be cautious in interpreting these results. However, to the extent that individual-level changes in cocoa output among members provide a proxy for the returns to program participation, the results suggest that farmers who experience low returns may be less willing to continue in the program. This may reflect a process of learning about individual-specific returns to fertilizer, particularly if farmers enter the program with optimistic prior beliefs about their idiosyncratic expected returns (see Miguel and Kremer 2003 [5]for evidence of how updating beliefs affects program retention in the context of a deworming intervention in Kenya).

# 5 Further questions and proposal for continued work

The analysis presented presents evidence of a program that is highly successful on average at raising output in the short term. Economic and agronomic returns are both substantial and statistically significant in the GCFS 2008 data.

However, several key questions cannot be answered in a satisfactory way with the available data. Here we emphasize three such questions:

1. In light of agronomic evidence that the returns to fertilizer use should be increasing over time, how large are the agronomic and economic impacts of CAA membership in the second and third years of membership?

2. What is the role of agronomic extension services and business management skills in promoting effective input use and high repayment rates?

3. What factors determine the high rate of dropout at group level? Is the high rate of dropout at the group level driven by repayment problems alone, or do farmers' perceptions of economic returns, among other factors, influence group retention as well – and if so, what policies can be undertaken to improve repayment and retention?

4. Can CAA credits be scaled up while maintaining their effectiveness by increasing loan allocations to farmers? To what extent are agronomic risks such as weather a barrier to farmers demand for further inputs and effective use thereof?

We propose to expand collaboration between CAA, TechnoServe, CSAE, and the Ghana Cocoa Board in order to investigate these issues. The proposed collaboration would take two forms: the collection and further analysis of *observational* data, and the design and execution of a randomized controlled trial. We describe the details of each proposal in turn below.

## *5.1 Data collection and analysis*

- **Question (1) – long-term impacts**

Two key features of the GCFS 2008 sampling design allowed us to evaluate the impacts of CAA membership on first-year members: (a) the ability to draw a representative sample of CAA members depending on their year of entry; and (b) the ability to draw a representative sample of *non-members* in the same locations. We have argued in Section 2 that these are important complements to the collection of panel or recall data that could capture production outcomes before and after entry into CAA, since these aspects of our sampling design help us to address sources of selection bias.

In order to evaluate the impact of the second year of CAA membership, we propose to (i) revisit the 336 farmers sampled in the GCFS 2008 to track changes in their outcomes, and to (ii) add a representative sample of farmers who joined CAA for the first time in 2009/10. We propose to undertake this survey work in August – September of 2009, collecting data relevant to the 2008/09 and preceding cocoa seasons.

- **Question (2) – Retention**

The question of how productive outcomes both at the individual level, and among friends and neighbors, affects dropout from CAA membership is crucial to understanding problems of retention that potential hamper expansion and long-run impacts of the program. We propose both further analysis of existing data and an arm of a randomized controlled trial (the latter is described in Section 0 below) to address this question.

Because the detailed questionnaire necessitates a smaller sample size, the GCFS dataset is somewhat limited in its ability to address the question of what determines dropout from CAA membership. This limitation is evident in the 2008 dataset, where

Our proposal in this regard is to partner with TechnoServe to (a) link the survey data that they have collected to CAA administrative data; and (b) jointly undertake further analysis of the TNS survey data to examine how dropout is affected by individuals' productive experiences and those of their peers.

The econometric methods available with such a dataset would allow us to investigate a key question: do individuals learn from their fellow group members about the profitability of CAA membership?

As discussed with TNS in a follow-up to the February workshop to discuss evaluation results, it is hoped that this work will be the first step in a collaborative data collection process, in which the CSAE can provide additional technical capacity, resources, and training in computerized data collection to the annual evaluation survey that TNS has been conducting. Harmonization of survey instruments and sharing of data would be a further benefit to all concerned.

## *5.2 Randomized-controlled trial*

As proposed above, further information on the long-run impacts of CAA membership and on the reasons for dropout can be provided by the collection of additional data and the merger of existing datasets.

In collaboration with CAA and TNS, we propose to go beyond this observational work to analyze complementary policies that may improve CAA performance. This work would take the form of a randomized controlled trial (RCT). RCTs are becoming increasingly important in the

toolkit of development policy and are commonly viewed as a gold standard for the evaluation of policy interventions [6]. Such a RCT would comprise the piloting of a particular intervention – such as a modification of typical CAA conditions or practices, the extension of an additional service, etc – to a small group selected from within the farmers for which the CSAE has baseline data.[9] Allocation of farmer groups to a particular study arm (or to remain with the existing CAA policies – the control arm) is to be done on a randomized basis, so as to ensure comparability of farmers in each of these arms.

We propose four policy interventions designed to investigate key questions for the impacts, retention, and scalability of the product offered to farmers by CAA.

*i. An informational intervention for improved retention following the 2009/10 season.*

As highlighted in this Report, retention of CAA members – even when they are able to repay their loans in full – remains a problem for the program. Available evidence suggests that this may relate to farmers' perceptions of the economic returns to participation in the program.

The vast majority of locations where CAA groups are present contain only one group. This implies that farmers depend primarily on their own experiences and the experiences of their group co-members from which to learn about the economic return to the program.

We propose to design and evaluate a program which would help to increase the flow of information across farmer groups, allowing them to communicate about both production methods and, crucially, about the results of the program. We hypothesize that if farmers are able to see firsthand the high average returns to CAA membership experienced in other villages, they will be more likely to remain members themselves.

We would propose to design such an intervention to be launched in between November 2009 and January 2010, timed to coincide with the key period of repayment and decisions about subsequent membership.

*ii. Certification of property rights for CAA members in the 2009/10 season.*

[9] We propose to combine the GCFS 2008 sample with the expanded sample undertaken in August-September of 2009 to serve as a baseline for this purpose.

A complementary policy intervention raised by CAA during the Feburary workshop was the provision of assistance to farmers in obtaining legal certification for the land that they cultivate.

This serves CAA objectives, since it facilitates the identification of CAA parcels (indeed, it could be made a part of a process of taking GPS coordinates of farmer parcels). Moreover, it was suggested that the provision of this service might improve retention rates. Finally, a wide body of evidence from Ghana has shown the importance of the relationship between property rights security and investment incentives [7, 8]. By increasing the demand for productive investments, such as fertilizer use, that have long-term impacts on agricultural productivity, the increased security could increase both the demand for CAA inputs, incentives for repayment, and other key outcomes.

Together with CAA, we would propose to implement this over the course of the 2009/10 cocoa season, by visiting farmers within the baseline sample, surveying cocoa plots, and expediting application for certification of title. Links to ongoing work by the World Bank to expedite land rights administration could be fostered in order to facilitate this process.

*iii. Alternative mechanisms for increasing the number of acres covered by CAA loans.*

CAA has as its stated goal the expansion of its membership roster to 50,000 farmers. However, in order to maximize impacts on productivity, it may also be useful to increase the acreage covered for individual program members. To that end, CAA promoters already have the option of increasing the loan size to 4 acres in the second year and 6 acres in the third year of successful group membership. If loan sizes are increased, however, they must be increased by the same amount for all members of a given group under the current system. These *dynamic incentives* may play a role in achieving current repayment rates, since they reduce the incentives for strategic default.

This raises several design issues. First, it is of interest to know whether farmers are able to achieve similarly high returns on the extra acreage incorporated when they are allowed larger loan sizes. Second, while keeping all group members with the same loan size has advantages in terms of facilitating the sharing of labour among group members, it may potentially act as a constraint on the ability to borrow of members with the means and opportunity to undertake larger investments.

To address the first of these questions, we propose to increase loan allocations on a randomized basis to a set of second-year CAA groups with successful repayment

histories, while keeping a (small) group of second-year CAA groups at the original levels of 2 acres to serve as control. This could be done on a randomized basis as follows: CAA promoters could nominate eligible groups from within the baseline sample. Then from within these groups that are deemed credit-worthy according to the criteria normally applied, half would be selected to be offered the increased loan size.

To address the second of these issues, we propose to design and pilot a mechanism whereby groups of second-year farmers who are deemed credit-worthy by their CAA promoters could either choose (a) to remain at 2 acres per member; (b) to progress to 4 acres per member with joint liability; or (c) to keep 2 acres under joint liability, but to allow those members who so desire to obtain loans for a further 2 acres under individual liability. We propose to test the effectiveness of such a scheme – as compared to the existing method of offering only options (a) or (b) to successful second-year groups – in terms of generating demand for inputs, high agronomic returns, and successful repayment.

*iv. Weather or other micro-insurance for CAA members*

In the long run, farmers may be deterred from undertaking profitable investments – such as the expansion of their CAA loan sizes – because of the risk that factors beyond their control could result in losses, including the possibility of failing to repay loans.

An increasingly popular mechanism for reducing the environmental risks faced by farmers is the extension of weather-indexed insurance. By making use of the various weather stations in cocoa-growing areas of Ghana, it may be possible to create a disaggregated measure of rainfall exposure affecting cocoa production. Indeed, TNS has already undertaken some preliminary studies to assess the viability of doing so. Linking insurance to CAA's credits provides an opportunity to overcome some of the obstacles that have hindered previous efforts to provide such micro-insurance to producers in other countries, where low demand has sometimes been blamed on lack of trust in the insurance providers [9].

While there are certainly practical obstacles to be overcome, this is viewed as a potentially important area of work. We propose to work with CAA and TNS to develop and pilot a small-scale insurance product in the villages from the baseline study.

### 5.3 Related work

In conclusion we describe briefly a proposal for a parallel project which can further inform our understanding of how best to scale up private-sector initiatives such as CAA. We note that Cocobod is currently weighing plans to distribute some 200,000 bags of fertilizer to farmers, free of charge.

We note that the group-based input credit provided by CAA may achieve higher productive returns than such an approach, for several reasons: First, the process by which members self-select into CAA groups, combined with the system of group liability, gives them an incentive to ensure that all members have the means to make effective use of the fertilizer and other inputs provided. In this sense CAA may improve upon the *allocative efficiency* of a scheme such as that currently considered by Cocobod: inputs go to those who can use them well. Second, the technical assistance provided by CAA promoters and TechnoServe staff may improve inputs application and the use of other inputs, etc. In this sense CAA may upon the *productive efficiency* of at-large distribution: farmers are trained to make better use of the inputs they receive.

We are currently considering conducting a randomized controlled trial to estimate the productive impacts of this Cocobod proposal. We would do so by allocating fertilizer to a small number of farmers studied in the Ghana Cocoa Farmers Survey over previous rounds, but living in villages where there are no CAA members.

Results from a randomized controlled trial that gives a comparable amount of fertilizer to a representative sample of farmers in villages where CAA does not currently have operations would allow us to estimate the importance of the allocative and productive efficiency generated by CAA. A further possibility is that a sample of CAA farmers should be selected to receive this government allocation *in addition to* their CAA inputs. There is a potential complementarity here: since CAA members are already receiving technical advice, etc., they may be better prepared to make use of additional inputs then are members of the at-large farming population.

## References

[1] Cocoa Abrabopa Association. Presentation to CSAE/COCOBOD workshop on "Improving productivity among Ghaniana cocoa farmers through group lending", Accra, Ghana, February (2009).

[2] Field, E. *Journal of the European Economic Association* **3**(2/3), 279–290 April (2005).

[3] Arellano, M. *Journal of Econometrics* **59**(1–2), 87–97 September (1993).

[4] Schaffer, M. E. and Stillman, S. http://ideas.repec.org/c/boc/bocode/s456779.html, (2006).

[5] Miguel, E. and Kremer, M. Mimeo, Harvard University, October (2003).

[6] Duflo, E., Glennerster, R., and Kremer, M. Centre for Economic Policy Research, Discussion Paper No. 6059, January (2007).

[7] Besley, T. *The Journal of Political Economy* **103**(5), 903–937 October (1995).

[8] Goldstein, M. and Udry, C. *JPE* **116**(6), 98–1022 December (2008).

[9] Cole, S., Giné, X., Tobacman, J., Topalova, P., Townsend, R., and Vickrey, J. Mimeo, Harvard Universtiy, September (2008).