Cost-Effectiveness of Community-Based Gendered Advisory Services to Farmers: Analysis in Mozambique and Tanzania

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JEL Codes: O13, D61

#305

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Keywords: *sustainable land management, agricultural extension, cost-effectiveness analysis, paralegal services*

JEL codes: *Q16, J16, O13, N57*

1. INTRODUCTION

Impact evaluations have taken agricultural development research by storm, becoming more common in absolute terms as well as more prevalent within the development literature.[1] Rigor in causally identifying the impact of agricultural interventions and programs on farmers' productivity and welfare, among other outcomes, has also increasingly been able to influence the direction of public investments made by international agencies and developing-country governments in support of the agricultural sector and rural areas. For example, comparing by sector the number of World Bank projects that included impact evaluations, the agriculture and rural development sector had the most of such projects. Also, the share of all World Bank agriculture projects that conducted impact evaluations grew rapidly over time (IEG 2012).

But such analyses, however careful in identifying the cause-and-effect relationship between agricultural interventions and development outcomes, have mostly been silent on the costs required to achieve the benefits.[2] Arguably, the cost side is an important aspect especially in cases where such research seeks to inform policies and investments on the ground. In a few topics—especially those of particular concern for international development organizations, such as agricultural input subsidies—attention has been paid to the cost of agricultural initiatives, especially in comparison to the size of the benefits these same expenditures could have brought about had they been invested in alternative areas. But even in the case of input subsidies, analysis of the cost side has with a few exceptions (for example, Jayne et al. 2013) often been analytically casual and has not been subjected to the

[1] For example, agricultural impact evaluations relating to developing countries become more and more frequent over time. Of all such evaluations published in the time span of 2002 to 2008, 7 percent were published in 2002, increasing to 29 percent of published in 2008 (IEG 2011). The weight of agriculture-related studies among all impact evaluations has also been steadily growing. We considered all 4,351 impact evaluations captured in the impact evaluation repository of the International Institute for Impact Evaluation (3ie), accessed December 1, 2016, at http://www.3ieimpact.org/en/evidence/impact-evaluations/impact-evaluation-repository. Of all studies published between 1981 and 2000, the share of agriculture-related studies was 5 percent. In 2001–2010 the share was 15 percent, and in 2011–2016 it was 17 percent.

[2] Systematic reviews of the presence of cost-effectiveness or any other cost analysis of agricultural impact evaluations do not exist to the best of our knowledge—however, a study focusing on a subcategory within agriculture, namely public-sector incentives to farmers to protect biodiversity on farmland, finds that of 2,000 such studies, fewer than 5 percent include any meaningful cost data pertaining to these public initiatives (Ansell et al. 2016).

same care and rigor as the analysis of the benefit side of agricultural programs in standard impact evaluations. Cost-effectiveness analysis (CEA) in development that subjects both the costs and effects of programs to equal technical scrutiny, and brings them together in order to compare alternative interventions or modalities within interventions, is rare in the agricultural sector. In contrast, it has been far more common in the health and education sectors (for CEA literature reviews and methodological considerations specific to health and education, see Galárraga et al. [2009], McEwan [2012], and Dhaliwal et al. [2013]).

Our study contributes to rectifying this gap. The analysis presents CEAs on a prominent area in the agricultural sector, namely advisory services to farmers. Specifically, it provides guidance on how scarce public resources can best be allocated to achieve improved knowledge, attitudes, and practices on land rights for farmers and on agricultural management of land, through paralegal aid and agricultural extension interventions, respectively. Both interventions make use of trained and skilled community members to provide the advisory services to regular farmers, and both interventions give special attention to reaching both women and men with those services. The regional contexts for this paper are Mozambique and Tanzania, and the analytical context in both cases is an experimental design in the conduct of the advisory services interventions and the corresponding household and individual surveys, and unique and rich cost data associated with the programs. We provide detailed discussion of the CEA methodology employed in these advisory services contexts, including results based on differing assumptions and simulation under scale-up scenarios.

The next section lays out the programmatic context, describing the advisory services to Mozambican and Tanzanian farmers. Section 3 discusses the empirical method used in the cost-effectiveness analyses of those services. The data are described in Section 4, and Section 5 shows the results of the CEAs in Mozambique and Tanzania. The final section concludes.

2. THE COMMUNITY-BASED, GENDERED ADVISORY SERVICES IN MOZAMBIQUE AND TANZANIA

The primary concern of the two interventions studied here is the delivery of advisory services key to farmers' welfare, with particular attention to reaching both women and men smallholders. The general modality employed is to train qualified members of the community in both technical and soft skills so that they can be the conduit of rural advisory services to regular farmers in their community. The program in Mozambique focused on providing advice on appropriate sustainable land management (SLM) practices in agricultural production, while the Tanzanian intervention reached out to farmers with advice and information on land property rights, so that awareness of those rights would ultimately reduce land-related conflict and improve farmers' investment in their land as a consequence of strengthened tenure security. The implementation of both programs was randomized at the community level. Given this, the analysis of the impact side of the cost-effectiveness study is based on the experimental approach that underlies the interventions (Kondylis, Mueller, and Zhu [2015, 2017] and Mueller et al. [2016] provide more detailed impact evaluations of the Mozambique and Tanzania programs, respectively). The next two subsections provide an overview of the two programs. Further details on the design and coverage of the programs are captured in Sections 3 and 4, respectively.

2.1. Advisory Services in Agricultural Production Techniques

The agricultural production advisory services program took place in five districts across three provinces of Mozambique from 2010 to 2013, under the auspices of a broader World Bank smallholder development project in the country's Zambezi valley (World Bank 2007). The program's primary objective was to improve smallholders' knowledge and adoption of appropriate SLM practices in agricultural production. Its approach toward that objective relied on the use of contact farmers from within the communities as conveyers of SLM messages to other farmers.

Given that objective and general approach, the program employed two primary types of delivery of extension services, with a gender feature constituting the primary distinction between the two. In the first modality, one farmer in each community was assigned to serve as the contact farmer for all other farmers in the community. The contact farmer received training on SLM practices as well as equipment and tools to enable him to have his plot (or one of them, if there were multiple) function as a demonstration plot. Communities usually already had a person functioning as contact farmer—usually male—prior to the project, and the project worked with those individuals. In the second modality, in addition to the preexisting male contact farmer, an additional female contact farmer was identified, and she received the same training and tools as the male contact farmer. The objective of this modality was to improve access by women farmers to information and extension about agricultural conservation practices, under the expectation that women contact farmers are, for cultural reasons and due to the often gendered nature of social interaction in rural societies of many developing countries, better positioned to convey conservation messages to women.

2.2. Advisory Services Regarding Farmers' Land Rights

The second rural advisory services project focused on the provision of community-based legal aid to farmers to improve their knowledge about land rights and about the role of government agencies in shaping and protecting such rights. It was implemented from May 2013 through July 2014 by a nongovernmental organization, Mama's Hope Organisation for Legal Assistance (MHOLA), in two districts of the Kagera region of Tanzania. Similar to the agricultural extension program, the community-based legal aid intervention used as its core modality the sourcing of qualified members of the community and the training of those members in the hard and soft skills of land-related advisory service provision, so that they would then serve as resource persons on land property rights and conflicts, as well as be able to refer farmers to more formal government agencies for adjudication of specific cases when needed.

Like the agricultural extension program, the land advisory services program was highly sensitive to the gendered nature of knowledge and attitudes about land rights and the types of demand for advice given on land-related matters. The training of paralegal workers included, among other things, the differences in the bundles of rights that women and men have with respect to land held by the household, as well as the different informal norms that govern claims women and men can make on land under various circumstances. Unlike the agricultural extension program, the land legal aid initiative was not implemented through two different modalities with respect to sensitivity to gender.

3. EMPIRICAL METHOD IN COST-EFFECTIVENESS ANALYSIS

Before describing the data used in analysis of the cost-effectiveness of these rural advisory services, we first provide in detail the methodology employed in identifying and computing the relevant costs and their components, describe the use of information on program coverage in scaling the effects of the program, and present the analysis of the program impact as a key ingredient in the denominator of cost-effectiveness ratios (CERs). The method is both laid out in general terms as well as tailored to some of the specificities of the two advisory services interventions.

3.1. Costs

CEA in the context of this study brings together cost (and other) information with results from an impact evaluation of the interventions of interest. An important aspect of CEA is the determination of costs based on an appropriate framework. CEA needs to account for cases in which the agency carrying out the program under evaluation has embedded this program within its other operations. This is in order to ensure that costs associated with the program of interest are, as far as possible, disentangled from other costs incurred by the same agency. This was a greater concern for the Tanzania case than the Mozambique program. In the former, since implementing staff also worked on other projects and interventions, information on the actual time they allocated to the evaluated program was obtained from timesheet records, and that time was costed using salary information. This process captured actual staff contributions to the intervention, regardless of the original plans on how much time staff was assigned to the project. The percentage of the agency's indirect costs allocated to costs of the program of interest is equivalent to the share of this program's budget in the agency's overall budget for the two years concerned (2013 and 2014).

In a similar vein, in CEAs it is necessary to keep in mind that the public costs are not limited to those incurred by the institution that carried out the evaluated intervention. To consider how scaling up or replicating a given intervention can affect the full public expenditures necessary to implement it at a wider scope, it is important to also account for the expenses incurred by other public-sector entities in regard to the program, even if those entities are not the actual implementation agencies of the program. This again required greater attention in the Tanzania program, since the Mozambique project was highly self-contained and those public-sector providers that were on the project were fully paid by the project. In the Tanzania program, as there were cases where public-sector officials provided some (but not all of their) time to supporting the project, we collected monthly data on the time cost of public officials who were not project staff yet provided their services to the program, including through their involvement in workshops to train paralegals, meetings, and other program activities.

Programs usually involve activities, and therefore costs, at multiple levels, or tiers—for example, costs that accrue at the community level within a country, the regional level, and the central level. In the analysis, we categorize costs by tier in particular in the community-based gendered agricultural advisory services (CGAAS for short) program in Mozambique, given that this program had a much more pronounced jurisdictional hierarchy in implementation than did the Tanzania initiative, the community-based gendered land advisory services program (CGLAS for short). Total costs specific to a tier are defined here as those that would increase only in the event of inclusion of an additional such tier but do not change with treatment of additional units below this tier. For example, total administrative-post-level costs in the Mozambique program—such as the payment of salary of the two extension agents operating in an administrative post—will increase only through inclusion of an additional post into the project. But post-level costs do not increase if additional communities within the same post are inducted into the project; what does increase in the latter scenario are community-level costs only. The same logic applies to tier-specific costs at the other levels.

Conceptually, and given the administrative structure in Mozambique, we consider tier-specific costs at seven levels, corresponding to farmers, communities, localities, administrative posts, districts, provinces, and the central level.[3] Tier-specific costs are denoted as e. For example, the tier-specific cost at the post level, and in particular for the p^{th} post, is e_p. The number of posts in total is P. Then, the totality of tier-specific costs for posts is $\sum_{p=1}^{P} e_p$. Using analogous notation for all other tiers—that is, f, m, l, d, v, and n for farmers, communities, localities, districts, provinces, and the central level, respectively—total project costs C are:

$$C = e_n + \sum_{v=1}^{V} e_v + \sum_{d=1}^{D} e_d + \sum_{p=1}^{P} e_p + \sum_{l=1}^{L} e_l + \sum_{m=1}^{M} e_m + \sum_{f=1}^{F} e_f \qquad (1)$$

3.2. Periodicity

Planning of the broader Mozambique initiative that contains the project under analysis, i.e. CGAAS, began as early as 2007 (World Bank 2007). However, the study project with its specific intervention characteristics was not operationalized until 2010, and it was concluded in 2013. The CGLAS program spanned the period of May 2013 through July 2014.

The time dimensions of the CGAAS and CGLAS programs feature in the cost analysis in four primary ways. First, the periodicity is accounted for explicitly in the way that capital costs are annualized. Execution of the programs entails

[3] These subnational jurisdictions are referred to in Mozambique as *comunidades*, *localidades*, *postos administrativos*, and *distritos* in portuguese.

expenditures of different durability. Public works and construction of infrastructure imply larger bulk costs that generate outputs that remain usable over a number of years, while operational costs and services are provided on a continuous basis throughout the project period. We therefore annualize capital costs by spreading the cost of each capital item from the time of acquisition over the useful life of the asset. In order to annualize capital costs, we first need to estimate the useful lives for different capital items. Absent information on this that is specific to Mozambique and to Tanzania, we estimate these conservatively by doubling the useful lives as stated by US government guidelines for property and equipment capitalization of the different types of capital goods in our cost data (Section 1.35.6.10, "Property and Equipment Capitalization," in the *Internal Revenue Manual* of the Internal Revenue Service),[4] assuming that capital goods in Africa will be in active use for at least double the time of those in developed countries.

To implement this, we first classify costs at each tier a and each time period t into capital (k) and recurrent (b) expenditures, that is, $e_{at} = e_{at}^{k} + e_{at}^{b}$. We then annualize the cost of each asset A_{as} accruing at tier a and acquired at time period s, and obtain capital expenditures e_{at}^{k} by summing over the period from asset acquisition to the time period t—that is,

$$e_{at}^{k} = \sum_{s=1}^{t} \frac{r \cdot A_{as}}{1 - \frac{1}{(1+r)^{T_{Aas}}}}, \qquad (2)$$

where T_{Aas} is the estimated useful life of asset A_{as} and r is the interest rate. In other words, capital expenditures at a time period t include the annualized cost of all capital assets acquired for the project in that year and before.

Second, all costs are converted from nominal to real values. We use the annual consumer price index (CPI) for Mozambique from the World Development Indicators database, and the monthly CPI for Tanzania from the country's National Bureau of Statistics. The base year for both is 2010. Third, present values are derived

[4] Accessed in 2014 at https://www.irs.gov/irm/part1/irm_01-035-006.html#d0e1314.

to the time of the project start for each cost item in period t. Fourth and finally, as described later in Section 4.4, the surveys for both initiatives were conducted in two rounds, in the form of a midline survey and an endline survey for CGAAS, and with a base- and endline survey for CGLAS. We therefore conduct the CEA both at midline and at endline in the former, and just at endline in the latter case.

These second to fourth aspects of periodicity lead to this formulation for tier-specific costs at endline:

$$e_a^{end} = \sum_{t=1}^{T_{end}} \left[\frac{100}{\text{CPI}_t} \frac{e_{at}}{(1+r)^t} \right] \tag{3}$$

where CPI_t is the consumer price index for each period and T_{end} is the period of the endline survey. The expression is analogous for costs at the time of the midline survey in the case of CGAAS.

3.3. Costs Disaggregated by Program Modality

As remarked earlier, CEA is in most cases appropriately used to conduct comparisons in cost-effectiveness rather than to evaluate the cost-effectiveness of a program in absolute terms. In Section 2 we described the two distinct modalities employed in carrying out CGAAS—one modality had a focus on ensuring gender balance among the contact farmers, while the other did not. In this vein, one of the key comparisons this study undertakes is between the gendered and the basic extension modalities. Equation (1) represents total program costs, but now we seek to separately determine costs of each modality. Given that communities are the units of treatment and the modalities are thus carried out in mutually exclusive communities, the last two of the seven summands of Equation (1) are distinct by treatment modality, while the other five are not. Tier-specific costs associated with the six levels are assigned to the two modalities—as well as the areas where the intervention takes place but was not surveyed and not part of the CEA—in the shares corresponding to the modalities' shares of all intervention units (where the units of intervention are communities). The total costs associated with each intervention type j then are:

$$C^j = \alpha^j \cdot \left(e_n + \sum_{v=1}^{V} e_v + \sum_{d=1}^{D} e_d + \sum_{p=1}^{P} e_p + \sum_{l=1}^{L} e_l\right) + \sum_{m=1}^{M^j} e_m + \sum_{f=1}^{F^j} e_f \quad (4)$$

where $j = \{g, ng, ns\}$ may either represent the gendered (g) or the nongendered (ng) or basic treatment subject to this study, or the intervention component that is not subject (ns) to the impact- and cost-effectiveness evaluation. The shares assigned to each type of treatment add up to one, that is, $\alpha^g + \alpha^{ng} + \alpha^{ns} = 1$. Then, $C^g + C^{ng} + C^{ns} = C$; $M^g + M^{ng} + M^{ns} = M$; and $F^g + F^{ng} + F^{ns} = F$.

3.4. Scale-Up Analysis

A challenge that academic work needs to rise to, emerging from a concern of significant policy interest, is to provide analytical insights on how a program or project, often executed and thus evaluated on a narrow scale, would perform if it were scaled up. Our paper concerns itself with this question. To simulate the evolution of cost-effectiveness of CGAAS and its components, we first need to define precisely what form of scaling up will be assessed. In our analysis, the intervention is said to have been scaled up from communities to localities if all localities that contain at least one community originally receiving the intervention are, after scale-up, "saturated" with the intervention. In other words, after scale-up, all communities in each locality with at least one originally (that is, pre-scale-up) treated community now receive the treatment.

To demonstrate how expenditures change in the process of scaling up, by way of example suppose one of the intervention modalities j originally operates over a particular geographic space, and then it expands so as to saturate localities, with "saturation" defined as above. Then, after scale-up the total expenditure on the treatment type j is

$$C_{ul}^j = \alpha_{ul}^j \cdot \left(e_n + \sum_{v=1}^{V} e_v + \sum_{d=1}^{D} e_d + \sum_{p=1}^{P} e_p + \sum_{l=1}^{L} e_l\right) + \sum_{m=1}^{M_{ul}^j} e_m + \sum_{f=1}^{F_{ul}^j} e_f \,. \quad (5)$$

The subscript u signifies that the expression pertains to the scenario after an upscaling or expansion of the intervention type j, and the subscript l similarly indicates that the nature of the scale-up is one that leads to a saturation of localities, that is, by including additional communities into the project within those localities that originally contained one or more intervention communities. Comparing the elements in Equations 4 and 5, it is clear that $\alpha_{ul}^{j} \geq \alpha^{j}$ given that the share of communities that fall under intervention type j will naturally increase after expansion,[5] that is, given that $M_{ul}^{j} \geq M^{j}$. The same obtains with the number of farmers exposed to the treatment. However, in an expansion through saturation of localities, all costs at the post and higher levels remain unchanged, even though the share of them attributable to the intervention type does increase.

It is useful to point out that there is a key difference in the characteristics of costs disaggregated by intervention modality j, between the case of the original analysis and a scale-up scenario. In the latter, we are simulating a scaling up of the program types one at a time—that is, first we consider scaling up, for example, the gendered treatment, and in a separate scenario consider the scale-up of the basic treatment. The implications of this are that there is no scale-up analogue to Equation (1)'s total costs across all intervention components.

3.5. Aggregating the Effects

Coverage

So far, the methodological details outlined have focused on deriving the appropriate cost quantities. CEA needs, however, to also explicitly account for the coverage of the program in order to ultimately normalize costs by the program's reach. Analysis of the intervention draws on information on the total number of individuals by intervention community who are potentially affected by the program, disaggregated

[5] Equality holds only if localities are already saturated, so that scale-up through locality saturation does not lead to any actual expansion.

by groups relevant to the analysis. And in the case of the CGAAS program, which is geographically highly staggered compared with CGLAS, we also draw on details regarding the jurisdictional coverage of the program—that is, the number of intervention communities in each locality, the number of such localities in each post, and so forth.

The Mozambique and Tanzania interventions targeted household heads and spouses of heads with extension and land rights messages, respectively. The impact evaluation (described below) also focuses on deriving the impact of the initiatives on household heads and their spouses. Therefore, the relevant population in the coverage consists of such heads and heads' spouses. Gendered analysis is key in this study, and therefore the coverage data of this population of heads and heads' spouses are disaggregated by gender. Since, as detailed above, CEA in Mozambique will be comparative between the two extension modalities of the program, the coverage data are further disaggregated by these farmers subjected to the gendered and the basic extension treatments.

Effects

We bring together normalized costs and the relevant coefficients of the impact evaluation to generate the CERs. The impact evaluations of both interventions use an experimental approach. In CGAAS, communities are randomly assigned to the gendered treatment, the basic treatment, or a control status. In CGLAS, communities are assigned to either the (single) treatment or control group. In both cases, districts serve as strata for the randomization. From each of the treatment units, households were randomly selected to be surveyed, and data on a range of outcomes and other characteristics on both the household head and his or her spouse (if existent) were captured in a midline survey in Mozambique and a baseline survey in Tanzania, and then again in an endline survey in both (see Section 4.4 for sample size details). In Mozambique, the same survey was additionally administered to all contact farmers.

The impact evaluation coefficients used in the CERs of this study derive from the regression

$$Y_{fhm} = \beta + \gamma_q B_m + X'_{fhm}\delta + \varepsilon_{fhm}\ , \tag{6}$$

where Y indicates an outcome of interest with regard to individual/farmer f in household h and community m; B is a dummy variable equal to 1 if the community is subjected to the intervention and 0 if it is a control community, and thus the coefficient of primary interest is γ; and, finally, X is a vector capturing a host of control variables. Standard errors are clustered at the community level. The results are obtained with four main variations. The first type of variation consists of the outcomes of relevance to the study. Of interest is how the programs affect farmers' awareness, knowledge, and adoption of practices supported by the intervention—these are SLM practices in CGAAS and rights and rules with regard to farmland property in CGLAS. The second type of variation pertains only to the Mozambique program, which has two different treatment arms: B may represent the gendered or the basic treatment, or may pool both as a general extension treatment. Third, the analysis is separately conducted to examine the effect on women and on men. In the case of CGAAS, it is also conducted for just the contact farmers. And, again only in CGAAS, the impact is derived both at the time of the midline survey and at the time of the endline survey. Fourth and finally, in CGLAS, the econometric analysis derives three different estimates, indicated by the subscript q, for the impact of the intervention: an intent-to-treat estimate, a treatment-impact-on-treated estimate, and an analysis that accounts for potential spillovers to nearby communities.

3.6. Bringing Costs and Scaled Effects Together as Cost-Effectiveness Ratios

To finally derive the CERs, total cost by treatment type is normalised by its coverage and divided by the impact coefficient, so that

$$CER_{G,t}^{j} = \frac{C_t^j}{\gamma_{qGt}^{j} \cdot N_{qGt}^{j}} \quad (7)$$

for intervention type j (gendered treatment, basic treatment, or pooled treatment) and consideration of key (that is, heads and spouses of heads) farmers of gender G (male, female, or pooled across genders), where N signifies the number of farmers under these treatment and gender categories. The full set of subscripts and superscripts, not always indicated previously for cleaner notation, are shown here to emphasize that the CER will vary by treatment type and time point of evaluation in the case of Mozambique, by method of impact evaluation (intent to treat, treatment impact on treated, and accounting for potential spillovers) in the case of Tanzania, and by gender of beneficiaries for both programs.[6] Importantly, CERs are derived only in cases where there is an impact γ that is statistically significantly different from zero, as it is only sensible to identify the cost-to-effectiveness ratio if there is in fact a nonzero effect.

4. DESCRIPTION OF THE DATA

4.1. Cost Data

For each of the two programs, we collected detailed data on costs incurred by the implementation agency for the period of the project—May 2013 through July 2014 for CGLAS and 2010 to 2013 for CGAAS. The data were recorded monthly in Tanzania, and in an even more detailed manner in Mozambique, by time of acquisition or expenditure of each item or activity. The costs were all based on actual expenditures, and not on budgeted figures. In the case of CGLAS, cost data were submitted by MHOLA, the implementing agency, to the research team every three

[6] Note that the method of estimation (reflected by subscript q) changes not only the impact coefficient γ but also the assumed coverage of treatment N. For example, in the case of the intent-to-treat estimation, all communities originally assigned to treatment are considered for the population count, but in the case of the treatment-impact-on-treated estimation, it is the communities actually treated that are considered in N.

months, giving opportunity to obtain timely clarification and ask for corrections in cases of incorrect entries, while in the case of CGAAS data were obtained from the project after project completion. All data were available highly disaggregated by labor cost (including type of labor and type of compensation such as allowances, salary, stipends, and so forth), transport costs (for example, fuel), capital outlays (such as purchase of motorcycles and furniture), office operational costs, workshop and training expenses, and other categories.

In the Tanzania project, expenditures were recorded at the district level of the two intervention districts, such that the intervention cost can be measured separately for each district. Some types of costs that were more centralized and were not direct field outlays were assigned to the central project office in Bukoba. The spatial details of costs are richer and more complex in the Mozambique program. Costs at the lowest (community) level center around goods and services directly provided to contact farmers. Those contact farmers are trained on agricultural conservation practices as well as provided the necessary equipment and agricultural inputs to enable them to use some of their land as a demonstration plot. Contact farmers also receive bicycles so that they can more easily travel to individual farmers and advise them on SLM techniques directly at the site of those farmers' land. Besides the equipment to conduct the demonstration plot with the bicycle, contact farmers do not receive a salary for their time commitment. Among the extension methods to convey SLM practices to farmers is the use of field days, which incurs costs, for example, to reach farmers with the announcement of the field days in order to ensure strong attendance.

The most significant costs at the administrative post level are those associated directly with extension officers, of which two are deployed in each post. Extension officers receive salary, and living quarters are constructed for them and their family. Each is equipped with a motorcycle to reach contact farmers throughout the intervention communities in their post. At the district level, the program put in place a district facilitator and an environmental specialist to attend to various aspects of the project. Those two staff are also responsible for providing a one-week intensive training for the extension officers on SLM techniques. The district facilitators and environmental specialists are given a vehicle for their coordination and training work in their district. Central costs include all the expenses of compensation of non-field-project staff for them to design and conduct the program, their travel costs to get to the field sites, capital outlays such as for vehicles, and various operational expenditures.

In CGAAS, the empirical results are obtained across the board for four degrees of inclusiveness of different levels of costs. The highest degree of inclusiveness accounts for all four cost tiers, that is, for costs from the community to the central levels. The next highest degree of inclusiveness accounts for costs at the community, post, and district levels, leaving out central project costs. The remaining two more narrowly defined scopes for cost-inclusiveness follow analogously. Where post, district, and central project costs are accounted for, these are "distributed" across the intervention areas, in accordance with the share of communities under each intervention type. For example, in the analysis of cost-effectiveness of the gendered treatment arm, the share of central project costs included is equal to the share of all communities that are subjected to this treatment arm (see also the earlier Section 3.3).

4.2. Descriptive Tables on Program Costs

Tables 4.1 through 4.3 present disaggregations of the total cost of the projects under evaluation. Over the evaluation period of 2010 to 2013 of the Mozambique program, total project costs amounted to US$3.7 million[7] (or about 109 million Mozambican meticais), of which the largest share, 42 percent (46 million MZN), was incurred at the district level (see Table 4.1). Central expenditures, such as on overall project design and consultations with the relevant government and other actors in Mozambique, were also substantial, about a quarter of all costs. Expenditures closer to the ground, such as to hire and deploy extension agents (post level) and to train and provide contact farmers with the requisite equipment (community level), were

[7] All subsequent references to dollars pertain to US dollars.

relatively smaller. The bulk of spending was incurred in the middle years of the evaluation period.

--------------------- Table 4.1 here ---------------------

As Table 4.2 shows, operating costs make up a significant part of the program's expenditures, amounting to about 44 percent of expenditures. The second largest expense type is personnel compensation. Public works—for example, construction of housing for extension agents—make up the third largest category. Training for technical staff, extension agents, and contact farmers is in fact the smallest expenditure type in amount. Costs by district range from about $388,000 to $840,000, but central-level costs exceed those of the highest-cost district at about $916,000.[8]

--------------------- Table 4.2 here ---------------------

Table 4.3 presents an overview of CGLAS. By far the largest cost components are training expenditures, as well as salary and other personnel compensation. The program costs were frontloaded, into 2013, given that many of the preparatory activities take place at the early stages of the project, such as training the paralegals and acquiring vehicles and other capital items. In the aggregate, district-level costs are fairly evenly distributed between the two program districts. At 21 percent, central expenditures make up a fairly modest share of all costs.

--------------------- Table 4.3 here ---------------------

4.3. Program Coverage

Table 4.4 shows the coverage of CGAAS. As described in Section 2, the project

[8] Note that the costs by district reported in Table 4.2 include all costs at the community, post, and district level associated with each district, and thus are larger than the district-level cost row in Table 4.1.

randomly assigned communities to either the gendered or basic treatment. In each district, 15 communities were assigned into each of the two treatment arms (and another 10 to control status). Table 4.4 also shows the total number of men and women exposed to each treatment arm, based on data on the number of household heads and their spouses across the treatment communities and data on those individuals' gender. A total of about 102,800 people were exposed to the project. Of those, somewhat more were men than women, and more farmers were located in areas where the gendered treatment was conducted than the number of farmers under the basic treatment.

--------------------- Table 4.4 here ---------------------

Table 4.5 presents the simulated coverage of the program as it goes to scale, under two expansion scenarios: when the program components are scaled up to saturate localities, and when they are further scaled up to saturate posts. Note that the latter expansion is exactly equivalent to a full scale-up to all areas of the five project districts, given that each intervention type originally takes place in at least one community of each post in the project districts. The expansion scenarios we will analyze by simulation constitute a significant scaling up of the program: in the locality saturation scenario, the number of farmers under the gendered (basic) treatment increases by a factor of 4.7 (8.4), to more than 287,000 (345,000) farmers. In the post/district-saturation scenario, the number of farmers increases more than sixfold (ninefold) relative to the original program, to more than 382,000 farmers.

--------------------- Table 4.5 here ---------------------

Table 4.6 presents the coverage of CGLAS. By design, 70 villages were part of the intervention, with an equal number in each district. These villages overall are located within 32 wards. The number of individuals exposed to the treatment, at about 91,000, is somewhat lower than the number in the Mozambique program (about 103,000), with the number of women somewhat larger than men. The distribution of coverage is distinctly smaller in one district than in the other, given differences in village population size across the two districts.

--------------------- Table 4.6 here ---------------------

4.4. Household and Individual Surveys

The survey used for the impact evaluation of CGAAS was conducted in two rounds in the form of a midline survey in 2012 and an endline survey in 2013. Twenty households were randomly selected in each of the survey communities, of which 75 were under each treatment arm and 50 in the control group, resulting in a target sample size of 4,000 households. Individual-specific variables—on which our outcomes primarily rely—were captured from the household head and from his or her spouse separately. Ultimately, 5,884 individuals were surveyed in the midline survey, and 5,076 in the endline survey.

The CGLAS impact evaluation survey data are obtained from a baseline survey conducted in April 2013 and an endline survey in September 2014. Respondents were the household head and the spouse (where existent) of the head from 12 households randomly drawn from each survey community. These survey communities consisted of a census of all rural communities in the two study districts. The intervention was randomized across the communities stratified by district, resulting in 70 treatment and 69 control communities.[9] Given this design, the target sample size amounted to 1,680 households and 2,800 individuals. Given absent respondents, and some attrition, the final count of respondents was 2,413, of which 1,575 are female and 838 male.

The outcomes of interest in CGAAS are to understand how the SLM extension program and its gendered and basic modalities affected farmers' understanding and

[9] One originally planned control community dropped out as it was later established that it was in fact part of another control community, rather than a self-standing community.

application of agricultural conservation and other SLM practices. Specifically, we consider farmers' awareness, knowledge, and adoption of specific practices on which contact farmers have been trained and supported to on-train other farmers, such as strip tillage, mulching, and crop rotation. In total, eight SLM techniques are considered. Farmers' awareness is measured by asking them whether they have come across the technique in question. Their knowledge is ascertained by subjecting them to basic test questions pertaining to the technique and considering a score greater than a technically determined threshold to constitute having good knowledge about the technique. The exams were developed from the training manuals provided to the contact farmers. Farmers are said to have adopted the technique if they have applied it to any of their plots in the 12-month period prior to the survey date.

The analysis of CGLAS focuses on the ways that the community-based paralegal aid program affected women's and men's knowledge of their land rights and of the procedures to seek redress in cases of land disputes, as well as their attitudes and perceptions with regard to rights that men and women should be able to have with regard to land, their attitudes about the quality and fairness of the work done by various land administration and adjudication bodies, and finally any actions they have taken or their engagement with these bodies and interactions they have sought out with them. As in the Mozambique SLM program, respondents' knowledge was ascertained through test questions posed to them, based on exams developed from the training manuals administered to the paralegal aid workers.

5. RESULTS ON THE COST-EFFECTIVENESS OF THE TWO RURAL ADVISORY SERVICE PROGRAMS

5.1. Cost-Effectiveness of the Agricultural Advisory Services for Contact Farmers' Outcomes

Based on equation (7), Table 5.1 presents the cost-effectiveness ratios for the impact of the gendered treatment on contact farmers' knowledge of various SLM practices.

It is critical, at the outset, to restate what we discussed in greater detail in the methodology section—namely, that CERs should never be interpreted as reflecting costs that bring about only the impact implied in the particular CER. In this case, the intervention has, of course, impacts on a range of outcomes for the contact farmers—some of which we present in Table 5.1—as well as a range of outcomes for regular farmers (covered in Section 5.2). The same project expenses lead to a variety of outcomes—that is, the costs cannot be disaggregated by the different outcomes they produce, and outcomes cannot be aggregated in CEA the way benefits are aggregated in cost–benefit analyses given that in cost–benefit analysis outcomes are captured in monetary terms. Rather than evaluating CERs in their absolute magnitude, therefore, one should use them in comparative fashion, to determine the relative cost-effectiveness of different intervention components, of different reaching outcomes, and for targeting different groups of individuals.

--------------------- Table 5.1 here ---------------------

The CERs in Table 5.1 are given for different degrees to which higher-level costs associated with the intervention are accounted for, as discussed earlier in Section 3.1. While it is natural to expect that CERs are larger the greater is the extent to which higher-tier costs are accounted for, Table 5.1 shows how pronouncedly sensitive the results are to such degrees of cost inclusion. Contrasting the two extreme cases—inclusion of only community-level costs versus inclusion of the costs of the intervention at all four tiers of operation—the former is less than one-tenth the size of the latter. CERs that ignore only expenses of the intervention at the highest level are three-quarters of the CERs based on the full costs, and CERs accounting for the two lowest levels of expenses are less than a third of the CERs based on the full costs.

Table 5.1 shows that, among the SLM practices, the project was most cost-effective for upgrading contact farmers' skills with regard to contour farming practices, followed by strip tillage, and it was least cost-effective in strengthening broad SLM skills and mulching practices. The CERs differ pronouncedly, with the CERs for increasing contour farming knowledge being less than 15 percent of the CERs for mulching.

Whereas the CERs in Table 5.1 focus only on the gendered treatment arm, results in Table 5.2 enable a comparison of the cost-effectiveness of the gendered treatment arm with the broader intervention, which includes both gendered and basic treatments. The sensitivity of results to the inclusiveness of costs at different tiers that emerged from our earlier discussion of Table 5.1 reoccurs here in an additional way. Conclusions regarding the relative cost-effectiveness of the gendered treatment alone vis-à-vis the broader intervention depend on cost-inclusiveness. Greater inclusiveness—of all levels of costs, or costs up to the district-level interventions—leads to the conclusion that the general intervention is more cost-effective in improving contact farmers' awareness of SLM practices: CERs of the overall intervention are about 80 to 95 percent of the CERs of the gendered treatment. CERs of the general intervention and those that consider costs only through the administrative post level may be larger or smaller than CERs of the equivalent gendered intervention, depending on the SLM practice under consideration. However, CERs ignoring all higher-level project expenditures beyond the community level would suggest that the gendered treatment is more cost-effective than the intervention overall.

-------------------- Table 5.2 here --------------------

The cost-effectiveness of the interventions in increasing contact farmers' awareness of SLM approaches can, as before, also be compared across these approaches. The gendered intervention has had associated with it the lowest cost for impact on awareness about row planting techniques, and the highest cost per impact in the context of pit planting as an SLM method. The cost-effectiveness ranking of awareness-raising of SLM techniques is not the same across intervention types considered. For the broad intervention (combining gendered and basic treatments), the greatest cost-effectiveness is achieved for contour farming, but as with the gendered treatment, the least cost-effective are the efforts to increase awareness about the pit planting technique. (This comparison across SLM practices is unaffected by the level inclusiveness of costs underlying the CERs.)

Table 5.3 is an analogue to Table 5.2 for contact farmers' knowledge about (rather than awareness of) SLM practices. Figure 5.1 provides a visually efficient comparison of the gendered intervention's CER with the overall intervention based on these results. Each line reflects the ratio between the gendered intervention's CER and the broad intervention's CER, for the different SLM techniques and under different degrees of cost-inclusiveness. While Table 5.3 indicates variation across SLM techniques and across cost-inclusiveness in terms of the comparison between the two intervention types, the graph leads to two key conclusions. The *relative* cost-effectiveness of the gendered treatment vis-à-vis the overall intervention is always highest (that is, the ratio of the two CERs is lowest) for improving contact farmers' knowledge of strip tillage practices. The gendered treatment's relative cost-effectiveness vis-à-vis the overall intervention is always lowest in regard to knowledge about the pit planting method.

--------------------- Table 5.3 here ---------------------

--------------------- Figure 5.1 here ---------------------

The gendered treatment's cost-effectiveness relative to that of the overall intervention improves the less inclusive are the costs accounted for in the CEA methodology, and thus it is lowest if only the most locally incurred costs are considered. In that case, this ratio is less than 1 for all SLM practices; that is, the gendered treatment appears as having a higher cost-effectiveness than the overall intervention in the narrowest method of accounting for costs.

When comparing the cost-effectiveness of the interventions in improving skills across SLM methods, we find a fairly consistent ranking from most (contour farming) to least (general SLM skills) cost-effective. This holds for either of the intervention types considered, and also holds irrespective of the cost-inclusiveness in the CER calculations.

5.2. Cost-Effectiveness of Agricultural Advisory Services for Regular Farmers' Outcomes

The preceding section focused on the interventions' cost-effectiveness for improving contact farmers' awareness of and skills with respect to agricultural conservation techniques. Given that the project's objective was to improve the understanding and ultimately adoption of appropriate conservation practices among regular farmers, who receive opportunities to learn from the contact farmers, we also conduct the CEA with respect to those farmers. Table 5.4 presents the results on the cost-effectiveness of the intervention components in improving regular farmers' awareness in SLM. As heretofore, we present the CERs under different degrees of cost-inclusiveness.

Additionally, the stability of the results will be examined for different ways of estimating the total number of farmers to which the CEA should apply. While the number of contact farmers was straightforwardly available for the earlier analyses, for regular farmers it is necessary to estimate the number of "key regular farmers"—that is, farmers that are either heads of households or spouses of household heads—given that they were the population targeted by the project, and thus also were the types of farmers included in the survey based on which the impact evaluation was conducted that generated the coefficients feeding into the denominators of the CERs. To obtain the count of key farmers in the communities where the intervention was carried out, information about the average household size for each locality was obtained both from Mozambique's latest population census and from the aforementioned household sample survey. CERs based on both are presented, and the variation is only slight. Moreover, all discussion below comparing CERs is not qualitatively affected by the household size employed to estimate the total number of relevant farmers.

As Table 5.4 shows, the gendered intervention, which trains and deploys a female along with the male contact farmer in each treatment community, is more cost-effective than the intervention component that does not include the additional female contact farmer. This holds irrespective of the cost-inclusiveness approach in CER calculation and is robust to the method of estimating the population of farmers subjected to the interventions. This is truly noteworthy and demonstrates the added value of CEA: in standard impact evaluation, it may be deemed unsurprising that adding a female to a male contact farmer improves outreach to regular farmers with SLM messages. This may be due not to a gender effect but simply to the increase in the number of contact farmers deployed. The CEA, however, accounts for all the additional costs incurred due to this numeric expansion, and in this case finds that despite the additional expenses, the gendered intervention is more cost-effective in improving regular farmers' information base about the SLM technique.

-------------------- Table 5.4 here --------------------

What is true for regular farmers as a whole is also true when considering male and female farmers separately. The gendered treatment is more cost-effective in increasing women farmers' awareness of the SLM technique and in increasing male farmers' SLM awareness. The only exception to this conclusion derives from the cost-inclusion methodology that accounts exclusively for the most local costs: in that case, the CER for the ungendered treatment is slightly lower than that for the gendered treatment, but only for male farmers. This is partly due to the fact that a large part of the costs that derive from the addition of the second, female, contact farmer accrues at this local level.

Finally, Table 5.5 gives the CERs analogous to Table 5.4, but for farmers' adoption of, rather than information base about, the SLM technique. The impact evaluation coefficients were not consistently statistically significant for female farmers, and thus the table presents the CERs for all farmers and for male farmers. The ratios show findings fairly consistent with those in Table 5.4: at least for higher cost-inclusiveness, the gendered treatment is more cost-effective than the treatment arm including only male contact farmers. However, the difference in cost-effectiveness is by far not as large as in the case of awareness of SLM practices. Furthermore, the cost-effectiveness advantage of the gendered treatment is overturned for narrower definitions of costs (for example, costs inclusive through the post level and through the community level, for outcomes measured for all farmers, that is, in the first two rows of Table 5.5).

--------------------- Table 5.5 here ---------------------

5.3. How Would Cost-Effectiveness Change When Scaling Up the Program?

In analyzing the way that cost-effectiveness changes when a program is scaled up, we need to be precise about the nature of the scale-up. As was explained earlier in Section 3.4, scaling up a given intervention component to the locality level means for our purposes that any given locality that originally contained one or more communities subjected to the intervention component is, after the scale-up, considered "saturated" by that intervention component. That is, scaling up implies that the treatment now takes place in each community of that locality. We maintain the earlier demonstration of CERs under different approaches in CEA in terms of inclusion of higher-level costs.

Table 5.6 reflects a comparison of the CERs in Table 5.4 with their analogue after a scale-up to the locality level (upper panel) and after a scale-up to the administrative post level (lower panel). In particular, it shows the ratio of each CER resulting from a simulated scale-up of the intervention to the corresponding CER without scale-up in Table 5.4. For example, the ratio in the first row, column 1, shows that if the program were scaled up within localities, the CER corresponding to the basic treatment would be 60 percent of the size of the same CER before the scale-up, under the broadest degree of cost-inclusiveness (inclusion of all costs up to the central level).

We do see significant variation in the gains from scaling up, depending on which intervention type is being scaled up. Generally speaking, these gains are found to be greater when scaling up the basic treatment than they are in the case of the gendered treatment: for example, while the basic treatment's CER after scale-up to the post level is only 58 percent of the original (pre-scale-up) CER, the gendered treatment's CER after such a scale-up is 91 percent of its pre-scale-up analogue. This is in part driven by the fact that the population newly reached through expansion of the basic intervention is larger than the population newly reached through expansion of the gendered treatment. While the gains in cost-effectiveness in the process of scaling up vary importantly depending on what modality (gendered versus basic) of the program is being scaled up, we do not see much contrast in gains in cost-effectiveness from scale-up when considering different target groups (male versus female farmers).

-------------------- Table 5.6 here --------------------

As seen in the above cases, gains can be had from scaling up in some cases. However, the results in Table 5.6 also make clear that scaling up need not improve cost-effectiveness. This is apparent, for example, in the evolution of the CER of the gendered treatment as it is scaled up to the locality level. Across all methods of cost-inclusiveness, the CER is larger after scale-up than before (i.e. all values in the upper panel are greater than 1 for the gendered modality). In these cases, aggregate benefits of the program would expand to a lesser extent than aggregate costs in the course of the scale-up—this can be affected, for example, by a lower population density of beneficiaries in the newly reached communities relative to the density of the originally treated communities.

The results also show empirically that there may be nonlinearities in cost-effectiveness in the process of scale-up. While as mentioned earlier there are gains from scaling the basic treatment to localities and further (small) gains to scaling it to posts, in other cases, cost-effectiveness could first decrease but then increase with further expansion. For example, scaling the gendered modality to localities results in a deterioration of cost-effectiveness (CER goes up by 7.6 percent), but scaling it further to the post level instead somewhat improves cost-effectiveness of this modality (CER of gendered treatment scaled up to the post level is 90.5 percent of original CER).

The degree of cost-inclusiveness in deriving CERs leads to strongly differing conclusions about the gains in cost-effectiveness of a program as it is scaled up. The ratio of the scaled-up CER to the original CER becomes larger (in other words, the gains from scaling up are smaller, or the losses larger) the narrower the range of costs accounted for—that is, as one moves from column 1 to columns 2, 3, and 4. This follows from the fact that the narrower ways of accounting for costs leave out more cost components that contribute to the economies of scale from expansion.

The analysis above illustrates the extent of gains in cost-effectiveness of the agricultural extension program were it to be expanded in scale. However, we may also want to ask whether the key conclusions drawn from the original program's CEA would obtain after the scale-up. Findings presented in Table 5.7 suggest not necessarily. The results here are the scaled-up analogue to results in Table 5.5, focusing on the cost-effectiveness of the intervention in terms of farmers' adoption of SLM practices. In scenarios of program expansion within localities, and expansion within posts, the basic treatment now emerges as more cost-effective than the gendered treatment. In the original program (see Table 5.5), it was the reverse, at least for the main scenarios. This example, combined with the analysis presented in Table 5.6, shows that nonlinearities along the expansion path, as well as different degrees to which cost-effectiveness changes across modalities, can result after a scale-up in reversals of conclusions regarding which intervention modality is more cost-effective.

--------------------- Table 5.7 here ---------------------

5.4. Cost-Effectiveness of the Community-Based Land Advisory Services Intervention

Table 5.8 presents the CERs for outcomes related to CGLAS. As with the Mozambique program, the CERs are derived only for those outcomes for which a statistically significant effect was detected, given that the "effectiveness" element of cost-effectiveness cannot apply where no impact was discerned in the regression analysis. As Table 5.8 shows, the cost per person of achieving outcomes related to knowledge and attitudinal changes with regard to land rights is moderate, ranging from approximately 14,000 to 43,000 Tanzanian shillings (TZS), or about $6.50 to $20. At this point it needs underlining again that, similar to the agricultural advisory services program, the very nature of the paralegal advisory services intervention does not lend itself to disaggregation of costs by the different outcomes that committing these costs bring about. In other words, it is not the case that certain inputs and activities are solely dedicated to bringing about certain outcomes, and other inputs to achieving other outcomes. Therefore, for example, the CER of 14.79 in Table 5.8 tells us that, accounting for the total costs of the intervention attributable to providing paralegal services to men, it takes about 14,790 TZS (or $6.50) per man to improve his knowledge on land rights with regard to government expropriation—but the same total expenditures on providing services to men also brought about other additional outcomes for men, as seen in the table.

-------------------- Table 5.8 here --------------------

Given the consistent methodology in deriving the CERs, these ratios can be compared against
each other. A gender comparison of the ratios shows that in all cases of statistically significant results, the cost of bringing about any given outcome per man is lower than the cost per woman for the same outcome. For example, the cost per man of improving knowledge about the government expropriation of land is 69.7 percent of the cost of educating a woman on this topic. Similarly, the cost to raise awareness

among men about the presence of paralegals in the village (about 20,500 TZS per man) is approximately 61.8 percent of the cost to raise such awareness among women (about 33,200 TZS per woman). However, the gender gap in cost-effectiveness is quantitatively somewhat narrower than if one considered the gender gap merely in terms of the marginal effects. For example, the marginal effect of the intervention on women's knowledge about government expropriation is 63 percent of the effect on men's knowledge on this topic. The difference in the gender gap of the CERs versus just of the marginal effect is because the CERs take into account not only total impact, which is affected by differential population size between men and women in the treatment areas, but also total costs—affected among other things by differential effort placed in providing land paralegal services to men versus women, as discussed above in the context of the cost and noncost data used and analyzed. Finally, Table 5.8 demonstrates that the CERs are fairly robust to differences in the underlying regression analysis—that is, whether it is based on treatment-impact-on-treated effects or intent-to-treat effects.

Table 5.9 presents the CERs that account for spillover of the project beyond the intervention areas. First, the fact that in the first two columns there exist some statistically significant effects based on which CERs could be derived suggests that there are spillover effects of the paralegal aid program. Those need to be accounted for, and we do so in the second two columns, which report the CERs based on program impacts comparing the treatment area to "pure control" areas—that is, after having removed the villages in high proximity to the intervention villages.

The CERs in the first two columns of Table 5.9 are naturally much larger than those in the second two columns, since the former reflect the cost of the total intervention but consider its improvement of knowledge, attitudes, and practices per person only in the areas outside of, but proximate to, the treatment areas. With such spillover areas being relatively small in scale and the costs incurred by the intervention pertaining to a much larger treatment area, the significantly larger CERs are expected.

A gender comparison of the CERs with regard to spillover areas wherever such a comparison is possible—namely, on the cost-effectiveness of increasing the sense of fair treatment by the land tribunal among men and women in spillover villages—shows that here the gender gap in cost-effectiveness dramatically narrows. The cost of increasing the experience of fair treatment by the land tribunal among men is nearly equal to—specifically, 95.6 percent that of—the cost of doing so among women in spillover villages. The fact that the cost-effectiveness gender gap is much larger when considering the direct effects of the program than the cost-effectiveness gender gap of the indirect effects of the program (that is, in spillover areas) is suggestive of the fact that indirect diffusion of the program's benefits may have more gender-equal "bang for the buck." It is, however, important to consider this possibility with caution, given that spillover effects are identified only on a few outcomes, and only in one case can the cost-effectiveness gender gap be measured. Finally, as was true in regard to the CERs in Table 5.8, across all gender comparisons in the CERs that account for potential for spillover in Table 5.9, the gender gap is always narrower than the equivalent gender comparisons of just the marginal effects.

--------------------- Table 5.9 here ---------------------

Finally, since some assumptions were necessary in the CEA—in particular, concerning the use of a discount rate and the useful life of capital costs—it is important to examine how widely the CERs vary with changes in these assumptions. As mentioned earlier in the subsection "Periodicity," the main results in Tables 5.8 and 5.9 are based on an annual discount rate of 3 percent and an assumed useful life of capital items double that in formal estimates for capital items in the United States. Appendix Table A.1 considers results for large variations in these assumptions: discount rates of 1 percent and 10 percent, and useful lives of capital equipment in Tanzania that are 1 times and 4 times those in the United States. It is apparent that our CERs are quite robust to such large changes across the four scenarios of discount rate and capital durability assumptions.

6. CONCLUSION

For research to inform policy and programmatic work in development, it is necessary to go beyond examining the impact of programs, projects, and interventions and to also provide evidence on programs' cost-effectiveness so as to provide useful guidance on what benefits accrue relative to the public expenses decision makers must incur to achieve those benefits. Cost-effectiveness analysis is not uncommon in the health sector and is also extant, although to a lesser extent, in education. However, there are as yet hardly any serious CEAs of interventions focused on farmers' economic activities and assets. We address that gap, specifically in the context of two interventions that use community-based trainers to increase female and male farmers' awareness, knowledge, and practices with regard to agricultural production and land rights. This study lays out in detail the methodological considerations in CEA in these contexts and presents results for the two programs. In so doing, we also take first steps to address another concern of major import for policy makers, namely, how cost-effectiveness may change as programs such as these are scaled up.

The agricultural advisory services program in Mozambique employed two modalities in conveying messages on sustainable land management practices to smallholders, with those two modalities differing in the gender sensitivity in selection of contact farmers to provide advice to regular farmers. In contrast, the land advisory services program consisted of a single modality. The nature of the agricultural extension program thus enabled a comparison in cost-effectiveness across two modalities of that intervention. Our analysis shows that the gender-sensitive modality is more cost-effective than the basic modality, and that it is also more cost-effective than the overall intervention (that is, when not distinguishing between the two modalities). Comparing the two modalities in terms of their cost-effectiveness, and not only their impact, is particularly useful in light of the fact that the addition of a second (female) contact farmer in the gendered modality also brings with it higher costs than the basic treatment that has only one (male) contact farmer per community.

Including a female contact farmer to work side by side with the male contact farmer more cost-effectively increases the awareness as well as knowledge of farmers about various SLM practices, such as contour farming, pit planting, and row planting. The stronger cost-effectiveness of the gendered modality holds up when considering awareness, knowledge, and adoption of farmers overall—not merely female farmers as recipients of advice. This advantage of the gender-sensitive modality in community-based agricultural advisory services is present quite consistently across different assumptions and variations in costing methodology. Exceptions where the basic treatment is more cost-effective are few—for example, under the narrowest inclusion of costs, namely, only those accruing at the community level, when considering awareness and knowledge of male farmers. Also, the basic modality was more cost-effective than the gendered modality in bringing about SLM adoption by male farmers.

While gender sensitivity in the supply of community-based agricultural advisory services generally has been shown to pay off, our findings indicate that, for any given modality, increasing male farmers' awareness, knowledge, and adoption of SLM practices is more cost-effective than strengthening SLM practices among women farmers. This conclusion is robust to the method used in terms of cost-inclusiveness across tiers. This is the case not only in the agricultural advisory services program but also in the community-based land rights advisory services project. In that project, too, efforts to improve knowledge and awareness of land rights among men are more cost-effective than increasing women's knowledge about land rights. The fact that it is cheaper to effect results for male than for female community members may be an outgrowth of gender differentials in the depth of knowledge and literacy at the outset: for example, considering men and women who at baseline cannot correctly answer which agencies deal with land conflict, the men's knowledge about this issue may be closer to the threshold of being correct than women's knowledge, and thus more time and effort, and thus costs, may be required to ensure women have the correct understanding about land-related agencies than to achieve this with respect to men.

Given the importance to programmatic work of how a project's cost-effectiveness may vary if it is scaled, we simulate the changes in CERs under various scenarios of scaling up the agricultural advisory services program (scale-up analysis was not undertaken for CGLAS, given limited granularity of cost data across tiers). Expansion of the basic modality of the program leads to improvements in cost-effectiveness, while the gendered modality displays nonlinearities along the expansion path: cost-effectiveness declines with initial expansion, then increases with further-reaching scale-up. Comparison of the cost-effectiveness across the two modalities after expansion shows that the earlier comparison becomes reversed: following scale-up, the gendered treatment performs worse in terms of cost-effectiveness than the basic treatment. These simulated results on how cost-effectiveness changes with program expansion—the positive findings as well as the less encouraging ones from the perspective of the contribution of the gender-sensitive modality in service delivery—can both serve as first indications that a naïve assumption of linear and proportional application of the original levels of cost-effectiveness to a scaled-up program may serve programmatic work poorly. More work, however, is certainly needed to deepen such simulation and conduct it in other contexts in a search for more widely generalizable patterns.

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TABLES

Table 4.1 CGAAS: Summary of costs of the agricultural advisory services program, by year and tier

Administrative level	2010	2011	2012	2013	All years
Community	781	2,939	8,057	1,592	13,369
Post	2,066	7,200	12,210	1,649	23,125
District	10,127	14,997	14,130	6,760	46,015
Central	3,465	7,257	9,564	6,641	26,927
All tiers	16,440	32,392	43,961	16,643	109,436

Source: Authors.
Note: CGAAS = community-based gendered agricultural advisory services. Values in 1,000 Mozambican meticais.

Table 4.2 CGAAS: Summary of the agricultural services program costs, by location and category

	Sofala province		Tete province	Zambezia province			
Cost categories	Chemba district	Maringue district	Mutarara district	Mopeia district	Morrumbala district	Central level	All tiers
Capital	649	3,116	4,978	3,088	2,946	2,090	16,868
Goods	1,698	815	2,743	2,195	3,470	819	11,740
Labor	1,807	1,807	1,269	1,172	1,172	18,054	25,283
Training	821	1,415	1,850	1,017	1,937	922	7,961
Operating costs	8,461	4,247	13,869	6,677	9,287	5,042	47,583
All categories	13,436	11,401	24,709	14,149	18,813	26,927	109,436

Source: Authors.
Note: CGAAS = community-based gendered agricultural advisory services. Values in 1,000 Mozambican meticais.

Table 4.3 CGLAS: Summary of costs of the paralegal program, by year, location, and category

	2013			2014			
Cost categories	Central level	Karagwe district	Biharamulo district	Central level	Karagwe district	Biharamulo district	All tiers and periods
Labor	11,058	9,334	8,544	7,697	5,890	5,890	48,413
Capital	5,300	350	0	0	0	0	5,650
Space rental	417	300	300	0	700	700	2,417
Training	1,100	34,181	34,550	0	0	0	69,832
Transport	1,140	100	135	1,428	0	0	2,803
Stationery	885	200	200	770	700	700	3,455
Meetings, other services	1,446	1,082	1,130	775	557	188	5,177
Food, other goods	0	7,872	8,226	0	0	0	16,098
All categories	21,346	53,420	53,085	10,669	7,847	7,478	153,845

Source: Authors.
Note: CGLAS = community-based gendered land advisory services. Values in 1,000 Tanzanian shillings.

Table 4.4 CGAAS: Coverage of the agricultural advisory services program in Mozambique

Coverage		Sofala province		Tete province	Zambezia province		All locations
		Chemba	Maringue	Mutarara	Mopeia	Morrumbala	
Posts		3	3	4	2	4	16
Localities		6	5	14	8	14	47
Localities involving basic treatment		6	3	10	7	13	39
Localities involving gendered treatment		5	4	9	7	7	32
Localities involving either treatment		6	4	11	8	13	42
Communities under a single treatment		15	15	15	15	15	75
Communities under either treatment		30	30	30	30	30	150
Individuals exposed to basic treatment	*Men*	1,265	1,184	5,481	8,679	5,026	21,635
	Women	1,164	1,128	5,038	7,872	4,575	19,776
	All	2,429	2,312	10,519	16,551	9,601	41,412
Individuals exposed to gendered treatment	*Men*	1,297	1,616	14,962	5,860	8,359	32,095
	Women	1,207	1,543	13,610	5,390	7,576	29,326
	All	2,504	3,159	28,572	11,250	15,935	61,421
Individuals exposed to any treatment	*Men*	2,562	2,800	20,444	14,539	13,385	53,730
	Women	2,371	2,671	18,648	13,262	12,150	49,102
	All	4,933	5,471	39,092	27,801	25,536	102,833

Source: Authors.
Note: CGAAS = community-based gendered agricultural advisory services. The number of communities under the basic treatment is the same as the number under the gendered treatment in each district. Given that in our project area each treatment arm is present in at least one community of each post, for each district the number of posts involving basic and gendered is identical to the total number of posts.

Table 4.5 CGAAS: Coverage under scale-up scenarios of the of agricultural advisory services program

Coverage		Sofala province		Tete province	Zambezia province		All locations
		Chemba	Maringue	Mutarara	Mopeia	Morrumbala	
Program coverage under scenario of scale-up to saturate localities							
Communities under basic treatment		129	110	112	63	223	637
Communities under gendered treatment		129	136	116	60	130	571
Individuals exposed to basic treatment	*Men*	11,412	10,725	42,816	27,270	88,535	180,758
	Women	10,547	10,229	39,296	24,934	80,213	165,219
	All	21,959	20,954	82,112	52,204	168,748	345,977
Individuals exposed to gendered treatment	*Men*	10,757	12,648	42,171	27,128	57,115	149,819
	Women	9,949	12,130	38,853	24,806	51,711	137,449
	All	20,706	24,778	81,024	51,934	108,826	287,268
Program coverage under scenario of scale-up to saturate posts/districts							
Communities under single treatment		129	136	133	63	243	704
Individuals exposed to single treatment	*Men*	11,412	15,887	53,455	27,966	90,844	199,564
	Women	10,547	15,220	49,351	25,557	82,286	182,961
	All	21,959	31,108	102,805	53,523	173,130	382,524

Source: Authors.
Notes: CGAAS = community-based gendered agricultural advisory services. Given that in our project area each treatment arm is present in at least one community of each post, three features hold: for each district (1) the number

of posts involving the basic treatment and the gendered treatment is identical to the total number of posts under both scale-up scenarios; (2) in the scale-up to posts/districts scenario, the number of communities and farmers under the basic treatment is equal to the number under gendered treatment; and (3) in the scale-up to posts/districts scenario, the number of localities involving a single treatment arm is identical to the total number of localities.

Table 4.6 CGLAS: Coverage of paralegal land advisory services program in Tanzania

Coverage		Karagwe	Biharamulo	Total
Number of wards		18	14	32
Number of communities		35	35	70
Individuals exposed to treatment	*Men*	26,697	16,488	43,185
	Women	30,383	17,730	48,113
	All	57,080	34,218	91,298

Source: Authors.
Note: CGAAS = community-based gendered agricultural advisory services.

Table 5.1 CGAAS: Cost-effectiveness of the gendered treatment of the program in increasing contact farmers' SLM knowledge

	Cost-inclusiveness—costs up to:			
SLM techniques	Central	District	Post	Community
Contour farming	623.82	483.79	244.02	150.96
Strip tillage	805.03	624.32	314.91	194.80
Pit planting	1,290.51	1,000.82	504.81	312.28
Crop rotation	1,341.72	1,040.54	524.84	324.67
Mulching	4,448.85	3,450.20	1,740.27	1,076.55
General SLM	1,523.03	1,181.15	595.77	368.55

Source: Authors.
Note: CGAAS = community-based gendered agricultural advisory services; SLM = sustainable land management. Values in 1,000 Mozambican meticais. Cost-effectiveness ratios are based on costs and impact by the time of the endline survey.

Table 5.2 CGAAS: Cost-effectiveness of the intervention in increasing SLM awareness

Cost-inclusiveness	SLM techniques	Gendered treatment	Any treatment
Central	Contour farming	529.96	774.41
	Pit planting	662.97	951.02
	Row planting	461.90	803.09
District	Contour farming	411.00	593.70
	Pit planting	514.15	729.10
	Row planting	358.22	615.69
Post	Contour farming	207.30	284.28
	Pit planting	259.33	349.12
	Row planting	180.68	294.81
Community	Contour farming	128.24	164.18
	Pit planting	160.43	201.63

Cost-inclusiveness	SLM techniques	Gendered treatment	Any treatment
	Row planting	111.77	170.26

Source: Authors.
Note: CGAAS = community-based gendered agricultural advisory services; SLM = sustainable land management. Values in 1,000 Mozambican meticais. Cost-effectiveness ratios are based on costs and impact by the time of the endline survey.

Table 5.3 CGAAS: Cost-effectiveness of the gendered and general treatment in increasing SLM knowledge

Cost-inclusiveness	SLM techniques	Gendered treatment	Any treatment
Central	Contour farming	623.82	1,047.51
	Pit planting	1,290.51	1,720.90
	Strip tillage	805.03	1,655.22
	General SLM	1,523.03	2,853.07
District	Contour farming	483.79	803.07
	Pit planting	1,000.82	1,319.33
	Strip tillage	624.32	1,268.97
	General SLM	1,181.15	2,187.31
Post	Contour farming	244.02	384.54
	Pit planting	504.81	631.74
	Strip tillage	314.91	607.63
	General SLM	595.77	1,047.36
Community	Contour farming	150.96	222.08
	Pit planting	312.28	364.85
	Strip tillage	194.80	350.92
	General SLM	368.55	604.88

Source: Authors.
Note: CGAAS = community-based gendered agricultural advisory services; SLM = sustainable land management. Values in 1,000 Mozambican meticais. Cost-effectiveness ratios are based on costs and impact by the time of the endline survey.

Table 5.4 CGAAS: Cost-effectiveness in increasing awareness of the pit planting technique of SLM

Gender	Treatment arm	Central		District		Post		Community	
		(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
All	Basic tr.	5.40	5.45	4.21	4.25	1.93	1.95	1.01	1.02
	Gendered tr.	3.21	3.22	2.56	2.57	1.33	1.33	0.83	0.83
Men	Basic tr.	7.74	7.80	6.04	6.09	2.77	2.79	1.45	1.46
	Gendered tr.	5.83	5.85	4.66	4.68	2.42	2.43	1.51	1.51
Women	Basic tr.	15.26	15.40	11.91	12.01	5.46	5.51	2.86	2.88
	Gendered tr.	7.09	7.11	5.66	5.68	2.94	2.95	1.83	1.84

Source: Authors.
Note: CGAAS = community-based gendered agricultural advisory services; SLM = sustainable land management. Values in 1,000 Mozambican meticais. Cost-effectiveness ratios are based on costs and impact by the time of the midline survey. Columns 1 and 2 use coverage based on household size estimation from the latest available Mozambique population census and from the household survey, respectively.

Table 5.5 CGAAS: Cost-effectiveness in increasing the adoption of the pit planting technique of SLM

Gender	Treatment arm	Central		District		Post		Community	
		(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
All	Basic tr.	11.89	11.99	9.27	9.35	4.25	4.29	2.22	2.24
	Gendered tr.	9.52	9.55	7.61	7.64	3.95	3.96	2.47	2.47
Men	Basic tr.	13.51	13.63	10.54	10.63	4.84	4.88	2.53	2.55
	Gendered tr.	13.65	13.69	10.91	10.95	5.66	5.68	3.54	3.55

Source: Authors.
Note: CGAAS = community-based gendered agricultural advisory services; SLM = sustainable land management. Values in 1,000 Mozambican meticais. Cost-effectiveness ratios are based on costs and impact by the time of the midline survey.

Table 5.6 CGAAS: CERs under scale-up scenarios as a share of CERs of original program

Gender	Treatment arm	Central	District	Post	Community
Scale-up within localities					
All	Basic tr.	0.600	0.637	0.832	1.162
	Gendered tr.	1.076	1.144	1.455	1.844
Men	Basic tr.	0.600	0.636	0.831	1.160
	Gendered tr.	1.079	1.147	1.459	1.849
Women	Basic tr.	0.601	0.638	0.833	1.163
	Gendered tr.	1.073	1.140	1.450	1.838
Scale-up within posts/districts					
All	Basic tr.	0.577	0.616	0.824	1.175
	Gendered tr.	0.905	0.972	1.283	1.672
Men	Basic tr.	0.577	0.616	0.824	1.175
	Gendered tr.	0.908	0.975	1.286	1.676
Women	Basic tr.	0.577	0.615	0.824	1.175
	Gendered tr.	0.903	0.970	1.280	1.667

Source: Authors.
Note: CGAAS = community-based gendered agricultural advisory services; CER = cost-effectiveness ratios. All underlying ratios pertain to the cost-effectiveness of the program in increasing awareness about the pit planting technique of sustainable land management. CERs are based on costs and impact by the time of the midline survey.

Table 5.7 CGAAS: Cost-effectiveness in increasing adoption of pit planting, under scale-up scenarios

Gender	Treatment arm	Central	District	Post	Community
Scale-up within localities					
All	Basic tr.	7.14	5.90	3.54	2.58
	Gendered tr.	10.25	8.71	5.74	4.55
Men	Basic tr.	8.10	6.70	4.02	2.93
	Gendered tr.	14.74	12.52	8.26	6.54
Scale-up within posts/districts					
All	Basic tr.	6.85	5.71	3.51	2.61
	Gendered tr.	8.62	7.40	5.07	4.12
Men	Basic tr.	7.79	6.49	3.99	2.97

Gender	Treatment arm	Central	District	Post	Community
	Gendered tr.	12.39	10.64	7.28	5.93

Source: Authors.
Note: CGAAS = community-based gendered agricultural advisory services. Values in 1,000 Mozambican meticais. Cost-effectiveness ratios are based on costs and impact by the time of the midline survey.

Table 5.8 CGLAS: Results of cost-effectiveness analysis, treatment based on assignment and compliance

	Based on treatment assignment		Based on actual treatment	
Outcomes	**Men**	**Women**	**Men**	**Women**
Believes wife should inherit		41.18		42.99
Aware of paralegal in village	20.49	33.15	21.63	34.61
Answered question correctly about who to approach in unresolved large land conflict	25.06		26.46	
Answered question correctly about government having the right to expropriate land for public use	14.79	21.23	15.52	22.26

Source: Authors.
Note: CGLAS = community-based gendered land advisory services. Values in 1,000 Tanzanian shillings.

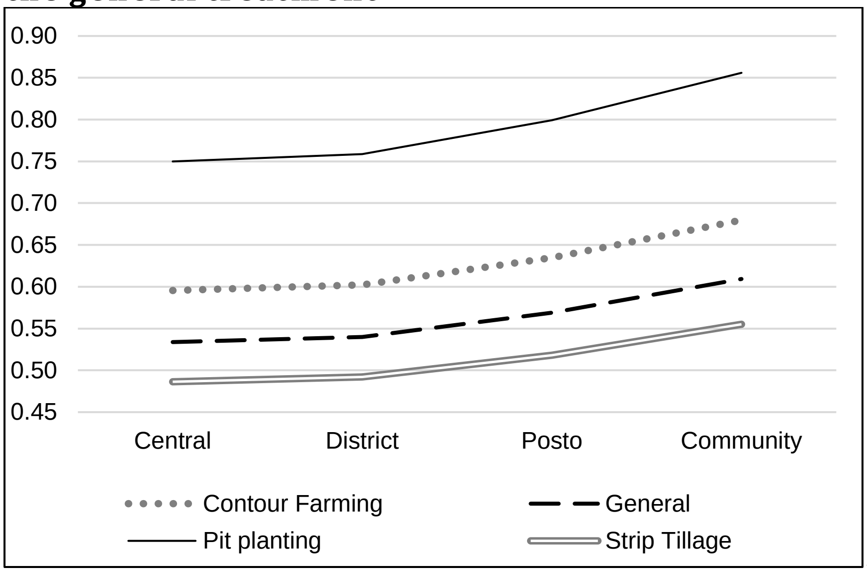
Table 5.9 CGLAS: Results of cost-effectiveness analysis accounting for spillovers

	Spillover effects		Pure effects (control excludes spillover areas)	
Outcomes	**Men**	**Women**	**Men**	**Women**
Believes wife should inherit				34.50
Believes land and housing tribunal treats cases fairly	107.77	112.73	32.26	36.04
Aware of paralegal in village			17.83	38.30
Answered question correctly about who to approach in unresolved large land conflict			30.24	
Answered question correctly about recognized son's entitlement to inheritance	79.34			
Answered question correctly about government having the right to expropriate land for public use			14.27	19.16
Attended seminar on legal rights in the last 12 months		487.33		

Source: Authors.
Note: CGLAS = community-based gendered land advisory services. Values in 1,000 Tanzanian shillings.

FIGURES

Figure 5.1 CGAAS: CERs of the gendered treatment as share of CERs of the general treatment



Source: Authors.
Note: CGAAS = community-based gendered agricultural advisory services; CER = cost-effectiveness ratios. Underlying CERs pertain to cost-effectiveness of the program in increasing knowledge about different sustainable land management (SLM) techniques: contour farming, pit planting, strip tillage, and general SLM knowledge. CERs are based on costs and impact by the time of the endline survey.

APPENDIX: SUPPLEMENTARY TABLE

Table A.1 CGLAS: Sensitivity analysis on discount rate and capital durability in paralegal land advisory services program

Outcome	Discount rate	Useful capital life	Based on treatment assignment		Based on actual treatment		Spillover effects		Pure effects (control excludes spillover areas)	
			Men	Women	Men	Women	Men	Women	Men	Women
Believes wife should inherit	0.01	1		41.74		43.58				34.97
		4		41.38		43.20				34.67
	0.10	1		40.37		42.15				33.82
		4		40.03		41.79				33.54
Believes land and housing tribunal treats cases fairly	0.01	1					109.24	114.27	32.70	36.53
		4					108.30	113.28	32.41	36.22
	0.10	1					105.67	110.53	31.63	35.34
		4					104.77	109.59	31.36	35.04
Aware of paralegal in village	0.01	1	20.77	33.60	21.93	35.08			18.07	38.82
		4	20.59	33.31	21.74	34.78			17.92	38.48
	0.10	1	20.09	32.50	21.21	33.94			17.48	37.55
		4	19.92	32.23	21.03	33.65			17.33	37.23
Answered question correctly about who to approach in unresolved large land conflict	0.01	1	25.40		26.82				30.65	
		4	25.18		26.59				30.38	
	0.10	1	24.57		25.95				29.65	
		4	24.36		25.73				29.39	
Answered question correctly about recognized son's entitlement to inheritance	0.01	1					80.42			
		4					79.73			
	0.10	1					77.79			
		4					77.13			
Answered question correctly about government having the right to expropriate land for public use	0.01	1	14.99	21.52	15.73	22.56			14.47	19.42
		4	14.86	21.33	15.60	22.37			14.34	19.26
	0.10	1	14.50	20.81	15.22	21.83			13.99	18.79
		4	14.38	20.64	15.09	21.64			13.87	18.63
Attended seminar on legal rights in the last 12 months	0.01	1						493.97		
		4						489.70		
	0.10	1						477.81		
		4						473.75		

Source: Authors.

Note: CGLAS = community-based gendered land advisory services. Cost-effectiveness ratio values in 1,000 Tanzanian shillings. The figures in the column "Useful capital life" signify the multipliers used on US government indicators of the length of life of various capital equipment and items. Thus, in rows with the number 1, the US indicators are used in the Tanzania data. In rows with the number 4, the length of equipment life in the data is assumed to be four times that in US accounting standards.