Choice Experiments in Developing Countries

Implementation, Challenges and Policy Implications

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11. Farmers' choice between public goods and agricultural extension packages in Ethiopia: a stated preference analysis

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INTRODUCTION

Currently, there is a general dichotomy in rural development policies. This dichotomy between extension-driven adoption of modern inputs on the one hand, and community-driven local public goods on the other hand, is particularly evident in the highlands of Ethiopia. Despite the obvious trade-offs between these two approaches, the target populations seldom get the chance to express their preferences for them. In this chapter we use a survey-based preference elicitation method – a choice experiments (CE) method – to examine the extent to which farmers prefer agricultural extension packages to two alternative local public goods – a health centre and a protected spring.

The current extension approach in Ethiopia, referred to as Participatory Demonstration and Extension Training System (PADETS) focuses on farmers' demonstration plots, and is based on the provision of input credit under local government collateral arrangements, institutional linkages with rural development committees and systematic inclusion of women and the young (Bonger et al. 2004). Food crops that are included in the extension packages are varieties of maize, wheat, teff, barley, sorghum and millet, while high value/commercial crops include coffee, peanuts, onions, tomatoes, cabbages, carrots and sweet potatoes. There are also packages in the livestock sector, post-harvest activities and natural resource utilization and conservation. Artificial fertilizer and improved seeds are the two most important inputs that have been adopted by Ethiopian farmers over the past decade or so. In spite of the removal of all input subsidies since 1997–98, consumption of fertilizer has increased somewhat. The quantity of improved seeds utilized has also increased. A dramatic change has also been

observed in the number of farmers participating in the extension system, as it increased from 31 256 in 1995 to 3 731 217 in 1999 (Bonger et al. 2004). However, in spite of the increase in the utilization of fertilizer and improved seeds over time, the rate of utilization per hectare is very low compared with a number of other developing countries. For example, fertilizer consumption per hectare of land used for cereal production for Ethiopia in 2002 was 15 kg compared with 31 kg for Kenya and 84 kg for Malawi (FAO 2004).

Expansion and improvement in health services is another important component of the government's attempts to bring about development. Access to health services is very limited, particularly in rural areas where about 85 per cent of the country's population resides. The mean distance to a health centre is about 7 km and the problem is more serious in rural areas where the mean distance is close to 8 km, while the figure for urban areas is about 1 km (MoFED 2002). There is also very limited access to safe sources of drinking water such as private and public taps and protected wells/springs. The source of drinking water for over 70 per cent of the country's population is unsafe and the figure is over 80 per cent for rural areas (ibid.).

By conducting the CE we are able to investigate how Ethiopian farmers evaluate the choice between extension packages and local public goods such as health centres and protected springs. The analysis also gives some insights as to the reasons for the low adoption of modern inputs in Ethiopian farming. In particular, the potential inclusion of an insurance component in such packages is discussed. It has often been mentioned in the literature that production and investment decisions of farm households in developing countries are affected by a multitude of risks, including crop failure and price risks.[1] Chemical fertilizers are usually obtained by farmers on short-term credit under institutional collateral arrangements. However, it has been noted in previous studies on Ethiopia that repayment requirements for short-term credit under uncertain weather conditions entail a high risk for resource-poor households (Kruseman 2003). We hypothesize that linking the existing extension package programme with some form of insurance improves the dissemination rates of extension packages. An important issue is the risk associated with fertilizer credit and measures taken by lenders when farmers fail to repay the loans. In a recent survey it was found that about 20 per cent of a sample of Ethiopian farmers who took fertilizer credit did not repay in full, and one important reason for this was bad harvest. Those who did not repay were faced with strict penalties such as imprisonment, or had to take such measures as selling livestock and other property or sell their food items (Bonger et al. 2004).

This chapter is organized as follows. The next section presents a description of the survey. The following sections describe the econometric model used and the results. The final section concludes the chapter.

DESCRIPTION OF THE SURVEY

The data for this chapter come from part of a rural household survey on sustainable land use in the Ethiopian highlands conducted in 2002. The data were collected through a Sida (Swedish International Development Cooperation Agency)/SAREC (Department for Research Cooperation) funded collaborative research project of the Departments of Economics of Addis Ababa University and the University of Gothenburg. The survey covered a total of 1520 households from two zones in the Amhara region of Ethiopia – East Gojjam and South Wollo. East Gojjam is generally considered to have a good potential for agriculture, whereas South Wollo is considered to be seriously affected by soil erosion and is subject to recurrent drought. Twelve research sites were purposely selected, six from each zone, while households within each site were selected at random. There was one supervisor for each of the sites under which enumerators were employed to conduct the interviews.

When analysing preferences, the standard method in economics is to use data stemming from actual behaviour. However, for several reasons we instead use a stated preference method. A stated preference method involves asking respondents to make hypothetical trade-offs between attributes; in our case choices between various extension packages and local public goods. First, we wanted to investigate directly the choice between direct private benefits and benefits provided by local public goods. Second, we wanted to investigate the preference for an insurance attribute of the extension package; an attribute that does not exist today. Third, with an experiment we have better control over the data compared to real behaviour. As with the other case studies presented in this book (for example, Chapters 7 and 13), we use the CE method to evaluate farmers' preferences.[2] In a CE, individuals are given a hypothetical setting and are asked to choose their preferred alternative from several alternatives in a choice set, and they are usually asked to perform a sequence of such choices. Each alternative is described by a number of attributes that take on different levels.

In the experiment, farmers were asked to make choices between an agricultural extension package and a local public good. Before the choice questions were asked, a scenario describing the attributes and the choice task was read out. The scenario is presented in the appendix. The head of the household (typically the husband) and another member of the household (typically the spouse) were asked the CE questions. The interviews with the husband and wife were made separately in order to ensure that they could not listen to their partner's decisions. However, the interviews were not always conducted at the same time or immediately after each other. We cannot therefore know whether some households actually discussed some of these issues before the next person participated in the interview.

The extension package was described as improved seed and modern agricultural inputs. The seeds could be either maize or teff.[3] These two crop types

were selected based on information about the most common crop types with improved seeds in the study areas. Before the actual experiment started, respondents had to decide whether they preferred the maize or the teff package and the chosen package was then used throughout the experiment. We allowed the respondents to choose from these two crops as the factors affecting their choice could differ across households and we wanted to reflect the needs of the respondents to make the experiment as realistic and feasible as possible. The extension package was described by two additional attributes: (i) the amount of money they would have to pay back at harvest time, and (ii) an insurance scheme. The levels of the first attribute were 200, 250, 300 or 350 Birr.[4] The insurance scheme was either present or not. The insurance was described as a system where they would not have to pay back the cost for the extension package if there was a crop failure.

This extension package was to be compared with the provision of a local public good. This good was either a health centre or a protected spring.[5] Both of these goods were described in the scenario. Each respondent made eight pairwise choices.[6] The cost of providing this extension package to a whole village varies. With an average cost of Birr 50 and 1500 households in a village, the total annual cost is Birr 75 000 or Birr 750 000 over a period of ten years.[7] This is comparable to the total cost of providing protected springs for one village, which would cost around Birr 1 190 000 for 17 springs (which would cover a village of 5000 people or 1500 households).[8] The total cost for a health centre for 5000 people over a period of ten years is estimated to be Birr 900 000, with fixed costs of Birr 400 000 and operating costs of Birr 50 000 per year. So the choices between these options are comparable on the supply side.

On the demand side, based on estimates from a survey in the study site, health and health-related expenditure (transportation, diagnosis, and pharmaceutical) of an average farm household is about Birr 378 per year. This does not include any amount paid to traditional healers, and free medical treatments they receive from health posts in each village. Production forgone due to time wasted during illness is also not considered. From the same survey, round trip time spent on water collection is about 42 minutes from open access supplies and 33 minutes from protected springs. On average, a woman makes one and a half trips every day to fetch water for the household. Using an opportunity cost of time of Birr 6 in rural Ethiopia, the cost of water collection is reduced from Birr 189/month in open access to Birr 148/month in protected spring. Here, the minimum net gain from gaining access to protected spring supplies is Birr 41/month or Birr 492 per year. This estimate does not include the additional benefit in terms of good health from drinking safe water.

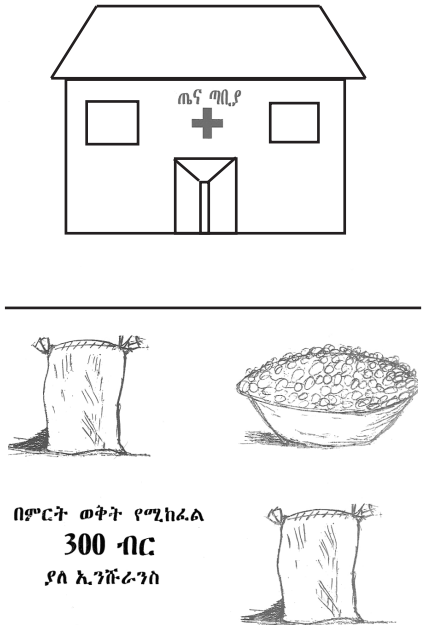
Although the return to fertilizer inputs depends on agro-ecology, crop type and the risk of crop failure, Mulat et al. (1997) estimated that the value–cost ratio of fertilizer ranges from 2.31 to 3.47 in the absence of any crop failure.

This translates to an annual return of Birr 577 to 867 for a 100 kg of fertilizer purchased at Birr 250. Thus, on the demand side, a comparison of an extension package to protect springs with the provision of a health centre is a relevant and a balanced choice. An example of a choice situation is described below in Figure 11.1.

Option 1	Option 2
Extension package	Health Centre
Payment at harvest time: ETB 200	
Insurance	

Figure 11.1. Example of a choice situation

Most of the respondents are illiterate, and it would be difficult, although not impossible, for them to remember the levels of the attributes. Here, the oral information was supplemented with pictures describing each choice situation. The interviewer held up different pictures describing each of the options. An example of such a choice set is depicted in Figure 11.2.



(*A health centre compared with fertilizer and improved seed which will cost Birr 300 without insurance to be paid during harvest time.*)

Figure 11.2. An example of cards describing a choice set

ECONOMETRIC MODEL

Since respondents' preferences are observed in terms of their choices, the random utility framework is applied when analyzing the responses (McFadden 1974). A latent indirect utility of the extension package for individual i in household h in choice situation t is defined as

$$U_{iht} = V_{iht}(\beta x_{iht}) + \varepsilon_{iht}, \tag{11.1}$$

where x_{iht} is a vector of CE attributes and socio-economic characteristics and β is the corresponding parameter vector. The indirect utility function consists of a deterministic, $V_{iht}(\beta x_{iht})$, and a stochastic, ε_{iht}, part. The respondent is assumed to maximize utility when responding in the experiment, but the utility function is not fully observable. Hence the stochastic element is added to the utility function. In the experiment, the respondents' choices between the extension package and the local public good are observed. A binary variable, y_{iht}, is defined to equal one if the respondent chose the extension package and zero if the respondent chose the local public good. The probability of this choice can be expressed as

$$P[y_{iht}=1] = P[V_{iht}(\beta x_{iht}) + \varepsilon_{iht} > \delta_t] \tag{11.2}$$

where δ_t is the utility of the public good in choice situation t. Since respondents in the household make repeated choices, the assumption of independence between observations may be violated since the choices can be correlated. Following Butler and Moffitt (1982) the error term is therefore specified as

$$\varepsilon_{iht} = u_{ih} + v_{iht};\ u_{ih} \sim N(0, \sigma_u^2),\ v_{iht} \sim N(0, \sigma_v^2) \tag{11.3}$$

where u_{ih} denotes the unobservable household specific effect of individual i and v_{iht} denotes the remainder disturbance; both being normally distributed. The components of the error term are consequently independently distributed and the correlation between errors is

$$Corr[\varepsilon_{iht}, \varepsilon_{ihs}] = \rho = \frac{\sigma_u^2}{\sigma_u^2 + \sigma_v^2} \tag{11.4}$$

This is a standard random effects binary Probit model (see, for example, Greene 2000). The model is restrictive in the sense that it assumes equal correlation across periods for each household. In the case of a CE, this implies an assumption of stable preferences and/or no learning or fatigue effects over the course of the choice sets for each household. Given the relatively simple

CE (few choice sets and few attributes), we believe that this is a plausible assumption.

DATA, RESULTS AND DISCUSSION

Based on the adoption of agricultural innovation literature (see Feder et. al. 1985 for a survey) a number of explanatory variables are chosen that are expected to affect the demand for an extension package, given the alternative opportunity of a health centre or improved water supply. The specification includes three sets of variables. The first describes the attributes of the experiment, that is, whether the household has chosen the maize or the teff package; whether the public good is a health centre or an improved spring; the amount that the household needs to pay back after harvest after having received the extension package, and whether this repayment needs to be done if there is a crop failure (insurance). The second set includes the standard socio-economic variables expected to affect such choices including the age, gender and literacy of the respondent, the family size, and wealth and resources indicated by ownership of livestock, trees and land. The third set of explanatory variables is chosen to control for the availability of the proposed goods. The preference for clean water is expected to be dependent on whether the household uses an unsafe source of drinking water and the distance to the water source. Similarly, the demand for a health centre is expected to depend on the distance to existing health facilities. Finally, interest in the extension package is expected to be positively correlated with past use of fertilizers. The descriptive statistics for the selected explanatory variables are shown in Table 11.1.

Our final data set includes 12 591 choices made by 1591 individuals in 1012 households in East Gojjam and South Wollo. A number of responses were excluded from the data set because of item non-response. In particular, 15 respondents that answered less than three choice sets (out of eight) were excluded, while 177 respondents were dropped from the analysis due to inconsistent responses.[9] As described above, choices were made between an agricultural extension package and a local public good (for the village). A large majority opted for the public good. The share of choices made in favour of the extension package was as low as 20 per cent. The proportion of households that chose the health centre and protected spring were 84 per cent and 76 per cent respectively. In Table 11.2, the share of respondents choosing the extension package at various levels of the attributes is presented.

As can be seen from Table 11.2, the respondents are rather unresponsive to the amount of money they have to pay back after harvest. The share of respondents opting for the extension package remains almost unchanged, although the cost increases by 75 per cent. However, the proportion choosing the extension

Table 11.1 Descriptive statistics

Variable	Description	Mean (std. dev)		
		Full sample	Wollo	Gojjam
Extension package	=1 if respondent chose extension package	0.20 (0.40)	0.14 (0.34)	0.28 (0.45)
Maize package	= 1 if respondent opted for maize package	0.28 (0.45)	0.18 (0.38)	0.41 (0.49)
Age	Age of respondent in years	42.86 (15.10)	43.77 (15.13)	41.72 (14.97)
Read and write	= 1 if respondent can read and write	0.32 (0.47)	0.35 (0.48)	0.29 (0.45)
Female	= 1 if respondent is female	0.50 (0.50)	0.50 (0.50)	0.49 (0.50)
Family size	Number of household members	5.79 (2.23)	5.86 (2.22)	5.70 (2.24)
Livestock	Animal holdings converted to tropical livestock units	3.15 (2.66)	2.54 (2.33)	3.91 (2.84)
No land	= 1 if household has no land	0.13 (0.33)	0.01 (0.09)	0.28 (0.45)
Land area	Land area in hectares	0.97 (0.69)	0.97 (0.55)	0.97 (0.84)
Fertilizer use	= 1 if household uses fertilizer	0.49 (0.50)	0.21 (0.41)	0.84 (0.37)
Unsafe water source	= 1 if source of drinking water is unsafe	0.19 (0.40)	0.13 (0.34)	0.27 (0.45)
Distance to health facility	= Distance to health facility (in hours)	0.48 (0.80)	0.38 (0.61)	0.61 (0.97)
Wollo	= 1 if household is located in South Wollo	0.55 (0.50)	n.a.	n.a.

Note: n.a. = not applicable.

Table 11. 2 Overview of share of respondents choosing the extension package for different attributes and attribute levels

Amount	200	250	300	350
	0.21	0.19	0.21	0.19
Insurance	Without	With		
	0.12	0.28		
Alternative public good	Protected Spring	Health Centre		
	0.16	0.24		

package more than doubles if the cost of inputs does not have to be paid in case of crop loss. This gives a clear indication of the importance of risk aversion in reducing the adoption rate of modern inputs in Ethiopian agriculture. It also gives an indication that these respondents are actually considering the attribute levels when they are making their choices, thus the fact that they are largely unresponsive to the changes in cost is not necessarily a sign of misunderstanding of the experiment. As we will see later on in the regression analysis, there are differences between the two regions when it comes to the responsiveness to the cost of input. Finally, there are also some differences with respect to the public good that they are asked to trade off against. The health centre is preferred to the protected spring.

In Table 11.3 the results of the estimation of the random effects Probit model are presented. The dependent variable is equal to one if the respondent opted for the extension package. The estimates for the pooled sample are followed by the estimates for the observations in South Wollo and East Gojjam, respectively, since we expect regional differences in agro-climatic conditions, potentials in agricultural productivity and profitability, and subsequently in preferences between the two zones.

The estimated correlation between the error terms, ρ, is high and highly significant throughout, which means we cannot reject the random effects model in favour of a more restrictive model with no correlation between the error terms. The dummy variable for the Wollo region in the pooled sample is also highly significant, strengthening our case for pursuing a regional division in the analysis. Furthermore, in a likelihood ratio test the hypothesis of equal parameters between the two samples can be rejected.[10] Here the separate regressions are now the focus.

Table 11.3 Results of random effects Probit model for the choice of extension package, standard errors in parentheses

	Full sample	Wollo	Gojjam
Constant	–0.883*** (0.204)	–2.467*** (0.277)	0.404 (0.300)
Attributes			
Amount payback harvest	–0.115*** (0.029)	–0.044 (0.041)	–0.163*** (0.042)
Insurance	1.115*** (0.024)	1.351*** (0.035)	0.962*** (0.036)
Health centre	–0.542*** (0.034)	–0.487*** (0.059)	–0.643*** (0.045)
Maize package	–0.338*** (0.040)	–0.596*** (0.076)	–0.312*** (0.049)
Characteristics			
Age	–0.006*** (0.002)	0.003 (0.003)	–0.020*** (0.003)
Read and write	–0.072* (0.042)	–0.098 (0.073)	–0.070 (0.057)
Female	–0.193*** (0.033)	–0.221*** (0.064)	–0.263*** (0.040)
Family size	0.024 (0.018)	0.009 (0.027)	–0.069** (0.027)
Livestock	–0.114*** (0.017)	–0.113*** (0.030)	–0.064*** (0.024)
No land	0.369** (0.150)	n.a.	0.154 (0.196)
Land area	0.310*** (0.075)	0.428*** (0.137)	0.217** (0.112)
Fertilizer use	0.111 (0.113)	0.011 (0.135)	0.272 (0.178)
Unsafe water source	–0.593*** (0.103)	–0.842*** (0.208)	–0.184 (0.131)
Distance to health	–0.001 (0.004)	–0.009 (0.011)	–0.010 (0.005)
Wollo	–0.894*** (0.121)	n.a.	n.a.
ρ	0.759*** (0.114)	0.806*** (0.014)	0.696*** (0.018)
Number of households	1 012	577	435
Number of choices	12 591	6 968	5 623

Notes: ***, ** and * represent significance at the 1, 5 and 10 per cent levels respectively. n.a. = not applicable.

Looking at the attributes of the CE, the coefficient of the amount payback is negative and significant in the Gojjam sample while in the Wollo sample it is negative but not significant. The result for Wollo may be taken as another indication of farmers' lack of interest for improved inputs. There could be many reasons for this, including agro-ecological conditions making it less profitable to apply fertilizers and improved seeds on steep and degraded soils. However, the risks involved in such applications could also be important, as indicated by the positive and highly significant coefficients for insurance. These results indicate that the high level of risk implied by taking farm inputs on credit is a major constraint for adoption of modern inputs in the Ethiopian highlands. Subsequently, if this risk could be addressed, by reducing the risk aversion of the farmers or through the introduction of some kind of soft default mechanism, then adoption rates could be expected to rise. The insignificant coefficients for past fertilizer use suggests that learning effects and experience from use of fertilizer do not play a role in farmers' choice of extension package.

The negative and significant impact of the health centre attribute suggests that of the two local public goods included in the CE, the respondents preferred a health centre to a protected spring. This is because including a health centre rather than a protected spring reduces the probability that the improved input package is chosen. The overall result, as indicated by Table 11.2, is that the respondent households in general prefer local public goods compared to the proposed extension package. The existing availability of such amenities had varied significance. Wollo households with unsafe water sources are more likely to choose the local public good, whereas the coefficient of this variable is not significant for households in Gojjam. The impact of distance to health services is, however, insignificant in both sub-samples. More disaggregated analysis of these data could be used for targeting community interventions. For instance, households that chose the maize package were less likely to prefer the extension package compared with those who chose the teff package.

The socio-economic characteristics also give some insights. The probability of choosing the extension package decreases with age in Gojjam while age is not a significant factor for Wollo. There is also a significant difference across gender. Female respondents are less likely to opt for extension packages than their male counterparts both in the Wollo and Gojjam sub-samples. Literacy is insignificant for each of the two sub-samples, maybe because increased literacy has a similar impact on both the preference for extension packages and health-improving local public goods. Family size has a negative and significant effect on choice of the extension package in Gojjam, suggesting that larger families in Gojjam prefer health facilities to the extension package protecting springs. The coefficients for livestock holdings are negative and significant throughout. A possible reason for this could be that manure from the livestock is a close substitute for chemical fertilizers. We also find that while household land

ownership is not significant in Gojjam, the size of land owned has a positive and significant impact both in Wollo and Gojjam. The positive effect of size of land could stem from the greater probability of being able to use modern inputs when a larger area of land is held.

CONCLUDING REMARKS

Rural development is of utmost importance in many developing countries, crucial in combating poverty, improving livelihoods and supporting the transformation of the whole society to more sustainable development, as expressed in the United Nations Millennium Development Goals. Over the years, numerous approaches and interventions have been tried in order to support rural development endeavours. From the perspective of a rural household, many of these interventions can be classified as either supporting the household directly with various inputs or supporting the community through various local public goods such as roads, schools, health care, and the like. Both approaches are currently used in Ethiopian rural development policies, but agricultural extension has so far been the dominant rural development strategy. However, it has been slow to penetrate rural agriculture and the farmers seem to 'vote with their feet' by showing great hesitation in adopting modern agricultural inputs that are made available, or more aggressively promoted by extension agents, with credit.

This chapter outlines the use of the choice experiment (CE) method of valuation to investigate the choices of a sample of Ethiopian farmers between an agricultural extension package (improved seeds and modern farm inputs) and a health centre or a protected spring. The agricultural extension package was proposed, with or without insurance, in the form of a loan to be repaid at harvest time. In some of the choices the extension package was bundled with a kind of insurance that meant that the credit did not have to be repaid in case of crop loss.

The results from this CE support the general impression that Ethiopian farmers are extremely sceptical about the adoption of an extension package made available with credit. When given the choice, a large majority rather chooses a local public good instead. The results also provide some further insights into the development dilemma that Ethiopian policy-makers, concerned with a structural food shortage, are facing today. This study, following Yesuf (2004), points out the importance of vulnerability and that the high level of risk aversion among farmers in the Ethiopian highlands affects their behaviour and limits their adoption of modern agricultural inputs. This situation, also described as a poverty trap (Dercon 2004), could be addressed either by reducing the underlying factors leading to the high degree of risk aversion (Yesuf 2004), or, as exemplified in our inclusion of an insurance component in the extension package, by directly reducing the risk from adoption.

This application also suggests that stated preference methods could be useful in designing policies and implementation of rural development projects. Despite the obvious trade-offs that have to be made when development interventions are designed, the preferences of the target group between private and public goods are seldom elicited in a structured way that enables aggregation and evaluation. Stated preference methods can be used for such purposes (see, for example, Köhlin 2001). The analysis in this chapter also gives numerous insights into factors affecting the preferences for various interventions and highlighted the importance of regional, household and individual characteristics in the formation of these preferences. Such information could be utilized to improve the design and targeting of rural development interventions.

Finally, some remarks about conducting a CE in this setting with illiterate respondents. We tried a number of attributes, and a number of ways to inform recipients about the attributes. In this particular setting with many enumerators, and interviews done in the field as part of a large survey, it soon became clear to us that we had to keep the number of attributes at a low level. Furthermore, without the accompanying pictures, many of the respondents had a hard time understanding the choices. Despite these efforts, we suspect that a number of respondents did not really understand the experiment, resulting in random responses. We think that one major reason for this was that the experiment was conducted as part of a large survey. While this gives us a great deal of interesting data to link with the behaviour in the experiment, the cost in terms of cognitive effort is there. One obvious way we could have reduced this would have been to conduct the experiment much earlier on in the interview. Another important lesson is the need to design the experiment in such a way that inconsistent respondents and random responses could be readily observed. For example, one could include strictly dominating alternatives as a way of checking if the respondents are paying attention.

APPENDIX: CHOICE EXPERIMENT SCENARIO

Consider that the project will be implemented in your village. Money will then be spent on community development in the community. Within the community workshop it has to be decided what to do with the money. There are essentially two alternative uses of the money:

(i) To directly support the households, for example by subsidizing agricultural inputs such as fertilizers and improved seeds; or
(ii) To invest the money in a protected spring or a health centre. In this part of the questionnaire we will ask you to choose between such alternative orientations of the project.

There are two possible community activities:

A. An additional protected spring would be constructed for the village. It will be located so that the walking distance from your house is approximately 15 minutes. The water in the spring is safe to drink and available all year round.
B. An additional health centre would be constructed and maintained in your Kebele.[11] The centre will have a number of trained health attendants. There is never more than two hours waiting time. Medicine and shots are available at the centre, but there are no sick beds. All services are provided at no cost for you.

Alternatively, the project could support you with an extension programme. With this programme your household receives subsidized inputs, advice on their application and in some cases an insurance. You can choose between a Maize package and a Teff package. The maize input package consists of:

> 50 kg DAP, 50 kg Urea and 12.5 kg hybrid maize seed, suitable for 0.5 ha,

or, for those who prefer Teff, the Teff package consists of:

> 50 kg DAP, 50 kg Urea and 17.5 kg improved Teff seed and 0.5 l herbicide, suitable for 0.5 ha.

The inputs would be available through the Office of the Agriculture Department of the Woreda (district) before sowing time.

Choice of package (only one choice possible):

Maize package:	(Yes=1, No=2)
Teff package:	(Yes=1, No=2)

These packages are similar to the current ones in the agricultural extension program. The payment is due one month after the main harvest. For research reasons we will make some changes to this package. We will vary the price that has to be paid at harvest time of this package and also introduce an insurance if there is a crop loss. The insurance would work like this: If there is a crop failure, the package will not have to be paid at all.

We will now ask you to choose between different such extension packages and one of the two community investments, either a protected spring or a health centre.

NOTES

1. For example in Yesuf (2004) it was found that risk preference is one of the major covariates explaining variations in fertilizer adoption decisions of the same sample of farm households as in this chapter. It was also found that many farmers had extreme levels of risk aversion.
2. For an overview of the CE method, see Alpizar et al. (2003) and Louviere et al. (2000), among others.
3. Teff is a cereal used to make Injera – a pancake-like bread – which is a staple food in most of highland Ethiopia in general and in the Amhara region, where the study areas are found, in particular.
4. At the time of the study, an extension package, given the description in our experiment, cost about Birr 275 in Wollo and Birr 300 in Gojjam. Hence, levels Birr 200 and 250 in our experiment imply subsidies of Birr 100 and 50 (equivalent to USD 12 and 6) in Gojjam and Birr 75 and 25 (equivalent to USD 9 and 3) in Wollo. With insurance, the subsidies are even greater.
5. A health centre that serves around 5000 people costs approximately Birr 250 000 to set up. In addition, operating costs would have to be covered. A protected spring that serves around 300 people costs around Birr 70 000. The operating costs are negligible.
6. The total number of combinations of attribute levels is 16. Therefore we created two different versions of the choice experiment, with eight choice sets in each.
7. Estimates based on personal communication with Amhara Bureau of Planning and Economic Development.
8. Estimates based on personal communication with Amhara Bureau of Planning and Economic Development.
9. Some respondents most likely misunderstood the experiment. They switched from preferring the local public good to the extension package as the amount of payback at harvest increased. We did not detect any systematic pattern explaining the inconsistent responses, so it is difficult to explain why these respondents were inconsistent. There are most likely two explanations: the low education level of the farmers and the length of the whole survey. The experiment was conducted at the end of a lengthy household survey. This meant that some respondents were tired, and there is a risk that this results in inconsistent behaviour.
10. In any discrete choice model the estimated parameters are confounded with the scale parameter; see, for example, Train (2003). In order to consider this fact when testing whether the parameters are equal or not we use the grid search procedure proposed by Swait and Louviere (1993). The relative scale parameter is estimated to be 1.36. Imposing this on the data we can reject the hypothesis of equal parameters between the Wollo and Gojjam sample. The χ^2 statistic for the null hypothesis of equal parameters is 64.14 with 16 degrees of freedom, and the corresponding critical value of the χ^2 distribution at the 95 per cent confidence level is 26.30.
11. A Kebele is the smallest administrative unit of local government in Ethiopia.

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