Department for International Development

Willingness to Pay versus Willingness to Work: Does NREGA Target Women?

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August 2018

Infrastructure for Climate Resilient Growth in India (ICRG) Programme

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Abstract

This paper presents the results from a split-sample Discrete Choice Experiment (DCE) about improved water availability in rural India. Respondents were randomly assigned to one of two treatments using either money or work as the numeraire. We find that there is no significant effect of the numeraire on marginal utilities suggesting that welfare measures can be estimated using either of the two. At a more disaggregate level, however, we find that unschooled women are willing to *work more* but *pay less* compared to unschooled men. This suggests that labour can be successfully used as the numeraire to target women via self-selection. Our results further demonstrate high demand for water infrastructure compared to other works permitted under MGNREGA. This study informs the debate regarding the relative merits of using labour or money as the payment vehicle in DCEs as well as the optimal configuration of public projects including MGNREGA.

Keywords: MGNREGS, Contingent valuation, Discrete choice experiment,

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1. Introduction

Stated preference studies are increasingly used to estimate economic values of non-market goods and services in developing countries (Bennett and Birol, 2010). Results from such studies can accelerate sustainable growth in the developing world by informing public policymakers about the environmental and societal impacts of different policies. Non-market valuation studies thus provide relevant information to any decision maker who wants to achieve economic growth and improved social wellbeing simultaneously. There are plenty of examples from developed countries where especially environmental non-market values are being integrated into the decision making process[1]. Bennett and Birol (2010) argue, however, that such advancement in public policymaking is potentially more important in developing countries given that the effect of improved decision making is likely to be greater. This study adds to the growing yet limited body of literature that estimates non-market values in the developing world.

Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) is India's flagship national rural employment scheme. It was implemented as a pilot in 2006 and nationwide in 2008. The scheme aims to provide at least 100 days of paid employment annually to households who volunteer to do unskilled manual labour. It is the largest employment scheme in the world with almost 5 billion pounds disbursed to labourers and more than 50 million households benefiting during the 2016/2017 financial year (Government of India, 2018a). Another aim of MGNREGA is to create durable assets such as roads, ponds and wells. It is, however, often argued that the scheme is more focused on employment generation and less focused on asset creation. MGNREGA, therefore, does not reach its full potential in terms of building resilience of the rural poor.

This motivates another programme named Infrastructure for Climate Resilient Growth in India (ICRG). ICRG is a Technical Assistance Programme funded by the Department for International Development (DFID). The aim of the programme is, amongst other, to improve the quality of assets built under MGNREGA. It is a 4 year project (2016-2020) with a 10 million pound budget and it is implemented by four

[1] See for example the requirement for environmental impact assessments in the European Union as outlined in Directive 2011/92/EU and Directive 2001/42/EC, in Australia as outlined in the Environment Protection and Biodiversity Conservation Act 1999 and in the United States as outlined in Chapter 2 of the Environmental Protection Agency's Guidelines for Preparing Economic Analyses.

project partners (IPE Global, PWC, Ricardo Energy and Environment and the University of Manchester). The University of Manchester is involved in the creation of knowledge products and that is the context in which the present study takes place.

The aim of the study is twofold (1) to examine gender differences with respect to the numeraire used in non-market valuation and (2) to demonstrate demand for improved water availability. In 2015, more than 132 million people in rural India did not have access to basic water services (World Bank, 2018b). The problem is likely to be further aggravated during the summer season when many natural water sources dry out. Water scarcity is a life threatening issue to millions of people in India and other developing countries yet there were more works related to rural connectivity completed under MGNREGA in 2016/2017 than works related to water conservation (Government of India, 2018b). This study aims to support policymaking by estimating economic values for different types of water uses. The results can provide guidance for development assistance as well as for an improved configuration of MGNREGA.

2. Payment Vehicle

An increasing number of studies in the environmental valuation literature argue that monetary payment vehicles are inappropriate when a significant part of the population is engaged primarily in subsistence activities (see for example Hardner, 1996). It is estimated that 70 percent of the nearly 900 million rural residents in India depend primarily on agriculture for their livelihood (UNFAO, 2018). Many of these households have limited access to off-farm labour and since 82 percent of the rural farmers are small and marginal, they have little or no opportunity for generating income. According to data by the World Bank, more than 25 percent of the rural population in India lived on less than 1.90 US dollars a day in 2011 (World Bank, 2018a). Trade involving money will, of course, be limited amongst such low-income households and the exchange of many goods and services is therefore likely to take place using alternative forms of transaction such as barter or work exchange. In this context, it is often argued that monetary estimates of willingness to pay provide a poor measure of welfare. Surveys that ask liquidity-constrained respondents about their willingness (and ability) to pay using money as the medium of exchange risk

underestimating the demand of the good or service under consideration. When considering their budget constraints, low-income households will be able to contribute very little or nothing for a good with high benefits. In a contingent valuation study, Brouwer et al. (2009) find, for example, that rural households in Bangladesh are willing to pay substantially less for flood risk protection compared to the costs of the damage. 60 percent of the respondents refused to contribute money to an embankment project but 40 percent of these respondents indicated a willingness to contribute either labour or in-kind instead. The use of a non-monetary payment vehicle in addition to (or instead of) a monetary one is therefore likely to reduce zero bids and increase willingness to pay.

Similarly, in a meta-analysis of 21 contingent valuation studies about water service improvements, Abramson et al. (2011) find that willingness to pay is significantly lower in rural areas compared to urban areas as well as in smaller rural communities compared to larger rural communities. The authors argue that monetary exchange markets are limited in areas where population densities are low and differences in willingness to pay estimates are therefore likely to reflect inability and potentially inexperience in providing cash payments rather than an absence of demand for improved water services. Given that the provision of water services in rural areas of developing countries is considerably behind that of urban areas (WHO/UNICEF, 2017), it does indeed seem unlikely that the demand for water service improvements should be lower in rural areas.

In addition to the lack of ability in providing cash payments due to labour market imperfections, poor households also lack experience in exchanging money for goods and services which is likely to impact not just estimates of mean willingness to pay but also estimates of marginal willingness to pay through increases in hypothetical bias. Hypothetical markets involving monetary payments, such as those often utilised in stated preference surveys, are likely to be more unrealistic to poor households who are less integrated in labour, goods and credit markets (Gibson et al., 2016). In a study comparing stated and revealed willingness to work for tsetse control, however, Kamuanga et al. (2001) find strong evidence of hypothetical bias. It seems, therefore, that non-monetary payment vehicles, like monetary payment vehicles, fail to eliminate hypothetical bias. While the existing literature provides no evidence about the ability of non-monetary payment vehicles to reduce hypothetical bias,

Pondorfer and Rehdanz (2018) find that choice uncertainty is successfully reduced when respondents are asked for labour contributions instead of money contributions.

In an attempt to address the problems of using monetary payment vehicles in low-income economies, researchers have adopted a range of non-monetary payment vehicles including crops such as rice and maize (Shyamsundar and Kramer, 1996; Mekonnen, 2000; Sutton et al., 2008), everyday household items (Hossack and An, 2015) and meals to labourers (Diafas et al., 2017). However, the most common non-monetary payment vehicle in stated preference studies is labour contributions. All households are faced with decisions about how to allocate time between productive (paid or non-paid) and leisure activities which makes time contributions a popular alternative to money contributions. A respondent's willingness to allocate time towards receiving a certain good is, ceteris paribus, expected to increase with the perceived benefits of that good.

2.1. Money versus Labour

Swallow and Woudyalew (1994) conducted one of the first stated preference studies using labour in addition to money as the mean of contribution in a developing country. Ethiopian household heads were asked about their willingness to contribute money and time to a programme devoted to reduce tsetse flies using an open-ended contingent valuation format. More than half of the respondents were willing to contribute both time and money while a significant proportion of the remaining respondents were willing to contribute labour only. Other contingent valuation studies finding higher levels of acceptability for labour contributions compared to cash contributions are Echessah et al. (1997), Kamuanga et al. (2001), Asrat et al. (2004) and Hung et al. (2007). Pokou et al. (2010), on the other hand, found that 94 percent of the interviewed livestock farmers in Côte d'Ivoire were willing to contribute money while only 86 percent were willing to contribute labour in a study about tsetse control. This may, however, partly be explained by the fact that the farmers were spending money on drugs to prevent livestock diseases transmitted by the tsetse fly which means that they were already accustomed to paying money for tsetse control.

In order to assess welfare effects by comparing benefits and costs, many studies convert labour contributions into monetary contributions. Such task requires an

estimate of the opportunity cost of contributed time. Most studies use either individual specific or area average wage rates or a fraction thereof (Abramson et al., 2011; Casiwan-Launio et al., 2011; Arbiol et al., 2013; Vasquez, 2014; Gibson et al., 2016). A common finding when using this approach is that the average respondent is willing to contribute more labour than money. In a study about drinking water quality in Cambodia, however, Gibson et al. (2016) find no difference between willingness to pay and willingness to work. The authors argue that the opportunity cost of time equals the wage rate when there are functioning labour markets and that a monetary payment vehicle can be successfully used in such contexts. Similarly, Tilahun et al. (2015) find no difference between willingness to contribute labour and money when using individual-specific daily income as the opportunity cost of contributed labour.

In a travel cost study, Lloyd-Smith et al. (2018) estimate the value of leisure time by asking respondents to sacrifice free time for monetary payments. They find that respondents value their free time heterogeneously which is consistent with the use of an individual-specific approach to comparing money and labour contributions. The authors furthermore find that the opportunity cost of leisure time is only weakly correlated with the wage rate which suggests that the monetary value of labour cannot straightforwardly be used to value free time. In a discrete choice experiment about forest fire prevention, Durán-Medraño et al. (2017) adopt a similar approach by asking respondents to state the minimum amount of money that they would be willing to accept to work four hours in addition to the hours volunteered towards forest fire prevention. However, willingness to contribute is elicited in terms of time only so no comparison between time and money contributions is made.

An alternative approach to comparing labour and monetary contributions assumes that welfare measures can be estimated using either of the two numeraires when choices are constrained by both time and money (Eom and Larson, 2006). Following such approach, joint estimation of the marginal (dis)utility of time and money contributions can be utilised to elicit the shadow value of time. The implicit assumption is that the underlying preference structure is the same for both payment vehicles and that willingness to contribute more (less) labour than money is due to a low (high) valuation of time. Eom and Larson (2006) ask South Korean households about their willingness to pay money or their willingness to increase housework time

in order to improve water quality in a nearby river. They estimate the marginal value of housework time to be 70-80% of the wage rate on average.

Non-monetary payment vehicles have also been used in the developed world. Davies et al. (2014), for example, conduct a discrete choice experiment about the role of paleoecology in decision making amongst researchers, policymakers and practitioners in the United Kingdom. The payment vehicle is the time required to broaden the evidence base but the focus of the study is on the trade-offs between attributes related to data requirements and not valuation per se so no attempt to compare time and money is made. In another discrete choice experiment, Durán-Medraño et al. (2017) elicit willingness to volunteer time to a programme aimed at preventing forest fires in Spain. The authors argue that the use of time as an alternative to money reduces hypothetical bias for goods and service that are frequently provided through NGOs and local institutions.

2.2. Gender

While the literature comparing monetary and non-monetary payment vehicles is growing, only a few papers have addressed the impact of the payment vehicle on male and female respondents separately. India is predominantly a patrilineal society and gender discrimination exists in many contexts for example relating to property rights (Chakravarty et al., 2018), education (Kaul, 2018) and nutrition (Aurino, 2017). In recognition of this vulnerability, many projects and programmes include provisions aiming to empower women. MGNREGA stipulates, for example, that at least one-third of the beneficiaries be women. Information about how payment vehicles can affect women compared to men is relevant to decision makers who are looking to implement gender-equitable or female-favoured policies.

Respondents in studies that examine the impact of payment vehicle across gender are mostly household heads. In an open-ended contingent valuation study amongst household heads in rural Kenya, for example, Echessah et al. (1997) found that male-headed households, ceteris paribus, are willing to contribute more labour but less money for tsetse control compared to female-headed households. The authors do not explore this finding any further except in an analysis of the average male and

female headed household, they note that the number of available adult labourers is lower in female-headed households. This observation is then used to calculate money and labour contributions as a percentage of income and available labour leading to the conclusion that female-headed households, mutatis mutandis, are more committed to tsetse control. Similarly, Tilahun et al. (2015) find that male-headed households, ceteris paribus, are more likely to accept higher bids in a contingent valuation study about forest conservation, especially in terms of labour, compared to female-headed households.

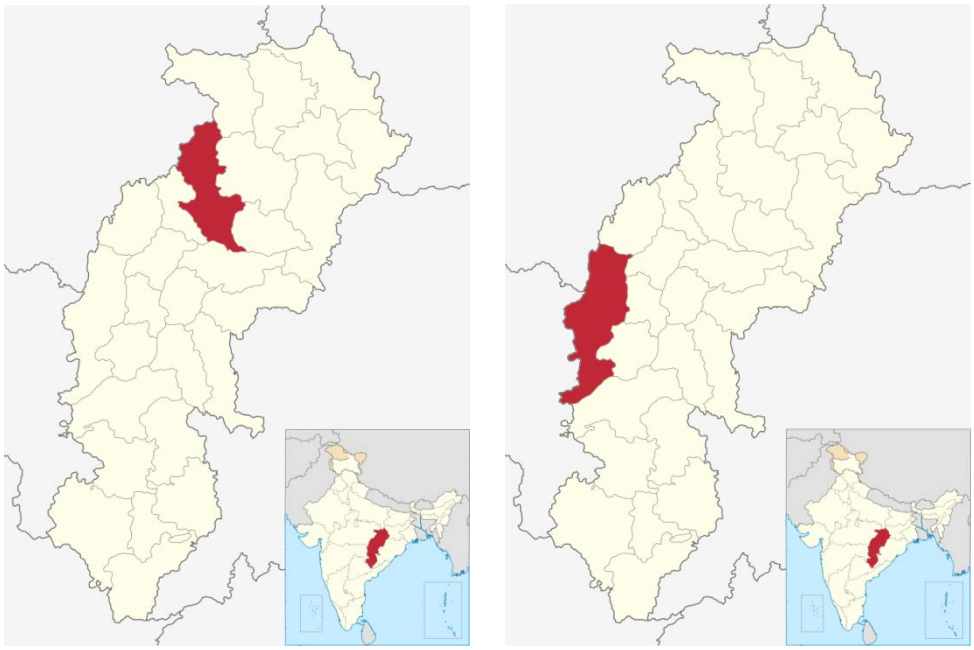
Larson et al. (2015) conduct a CV study in Botswana asking respondents to accept or decline wildlife conservation jobs with varying wages and varying time commitments. They estimate the (dis)utility associated with the work as well as the shadow value of time. The reservation wage (minimum wage required to accept the work) is the shadow value of time adjusted for the (dis)utility from the work activity. They find that women have higher disutility for almost all the different categories of work and a higher shadow value of time compared to men.

This paper provides the first study that compares monetary and non-monetary contributions across gender when a significant proportion of the sampled population is not household head. We argue that if women favour work as payment vehicle then such numeraire can be preferably used if decision makers want to include provisions that favour female preferences and empower women.

3. Survey Design and Data

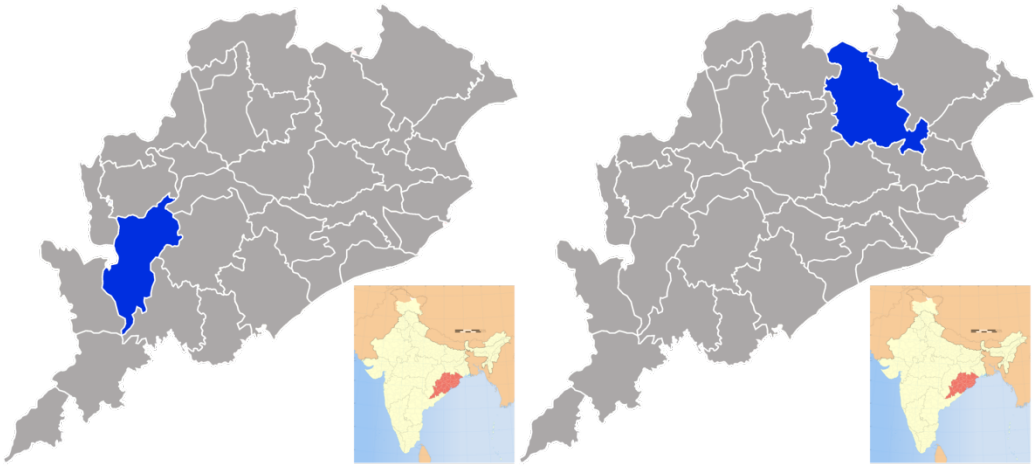
A discrete choice experiment (DCE) was designed to elicit the willingness of rural households in India to contribute money or labour towards improved water availability. The study was conducted in nine villages across four districts located in two states of India (see Figure 1 and Figure 2) during the months of January and February 2018.

Figure 1: Sampled Districts in Chhattisgarh



(a) Bilaspur (b) Rajnangaon

Figure 2: Sampled Districts in Odisha



(a) Kalahandi (b) Kendujhar

3.1. Sampling and Interviewing

Respondents were recruited by community facilitators employed by local NGOs. The community facilitators provided a familiar face to the respondents which is important because of the limited interaction of rural households with individuals from outside communities. The community facilitators also served as the main point of contact for obtaining authorisation from village leaders and they identified and organised suitable survey locations. Respondents were recruited one day prior to the survey and if they agreed to participate they were invited to the survey location either during the morning session or during the afternoon session. Only individuals who at least occasionally undertake manual labour were included in the sample.

The survey location was either in an office building or at a school and it was always within walking distance from the village. The interviews were conducted by research assistants who speak the local language (Hindi or Oriya). The research assistants were both male and female to avoid potential gender biases. Respondents were interviewed individually and it was ensured that the survey was conducted in an isolated environment without anyone listening or interfering. The survey was designed using Sawtooth Software Lighthouse Studio (version 9.5.3) and administered on tablets using an offline survey app. The interviews were conducted in conversational form because many of the questions required probing. Conversation also allows for better explanation of the hypothetical scenarios in the choice experiment and may therefore have reduced hypothetical bias (Hardner, 1996). A total of 481 respondents participated in the survey of which 401 are included in the analysis.

To compensate respondents for their time, they were gifted with a box of sweets after completing the interview. Monetary compensation was deselected due to the sensitive nature of cash in rural poor areas (Hossack and An, 2015). It is believed that cash payments would have attracted a lot of unwanted attention from villagers who were not recruited and potentially offended village leaders and other elite members of the community.

3.2. Attributes

The discrete choice experiment (DCE) was designed to elicit the willingness of rural households to contribute money or labour towards improved water availability. A reconnaissance visit to Chhattisgarh and Odisha in October 2017 revealed that the most important attributes relating to water use include irrigation for agricultural production, drinking water, water for domestic use, water for livestock, and water for vegetable cultivation. Designing a DCE with these attributes, however, is not straightforward because (i) *different* water uses may come from the *same* water sources, and (ii) the *same* water uses may come from *different* water sources. Both (i) and (ii) differ across households and also across seasons which complicates the design even further. There is thus no obvious way of defining attribute levels that are generic across respondents. One household may, for example, fetch drinking water from a well which means attribute levels could be in terms of trips taken, quantity collected or time spent but another household may rely on government supplied water which means attribute levels rather should be in terms of quantity or frequency of delivery.

After multiple dialogues with community members, community facilitators and local engineers, four attributes related to water use and availability were selected (see Table 1). The first attribute, *Months*, indicates the number of months where water is unavailable from a self-selected water source. Respondents were asked to think about the water sources currently used by the household. Of the water sources that occasionally dry out, respondents were asked to select the source that they would most want to hold water longer than usual. Subsequently, they were asked to indicate what they use the source for and the months in which water is typically unavailable from that source. To avoid multicollinearity, respondents were not allowed to select sources that they used for irrigation of agricultural fields or kitchen gardens.

Table 1: Attributes

Attributes	Description
Months	Number of months where water is unavailable from a self-selected natural water source (except sources used for irrigation)
DoubleCrop	Dummy variable (0 = single cropping, 1 = double cropping)
Yield	Kharif crop yield measured in quintal (1 quintal = 100 kg)
VegNo	Effects coded variable (1 = no vegetable cultivation, -1 = current vegetable cultivation, 0 = double vegetable production)
VegDouble	Effects coded variable (1 = double vegetable production, -1 = current vegetable production, 0 = no vegetable cultivation)
Labour	Person-days of unpaid manual labour (one-off contribution)
Money	Rupees (one-off contribution)

The second and third attribute, *DoubleCrop* and *Yield*, relate to water used for irrigation of agricultural fields. More than 80 percent of the sample is engaged in subsistence agriculture of which 89 percent practise single cropping. Single cropping in this context refers to farmers who harvest only one time per year. This crop is called kharif crop and it is cultivated and harvested during monsoon season (June to October). The second attribute *DoubleCrop* is a dummy variable indicating whether or not the household will be able to practise double cropping. Double cropping in this context refers to farmers who harvest two times per year. The second crop is called rabi crop and it is cultivated and harvested during winter or spring (October to March). Farmers whose agricultural fields are solely rainfed (89 percent of the sample) are generally unable to practise double cropping. The third attribute *Yield* specifies the kharif crop yield. Almost all of the farmers in the sample (98 percent) grow rice as their kharif crop. Both *DoubleCrop* and *Yield* were included because increases in kharif crop yield and the ability to grow rabi crop are likely to depend on two different types of irrigation systems. Protective irrigation systems (e.g., canals) are designed such that the available water is spread equitably over a large area to protect farmers against crop failure (Jurriëns et al., 1996). The aim of protective irrigation systems is thus not to supply farmers with water so as to maximise their yields but rather to provide enough to prevent crop failure. Protective irrigation systems are likely to reduce the risk of crop failure during kharif season but they are less likely to enable double cropping. Supplemental irrigation (e.g., farm ponds) is the addition of water to rainfed crops when precipitation fails to provide sufficient water. Supplemental

irrigation is smaller in scale compared to protective irrigation but more effective in enabling double cropping.

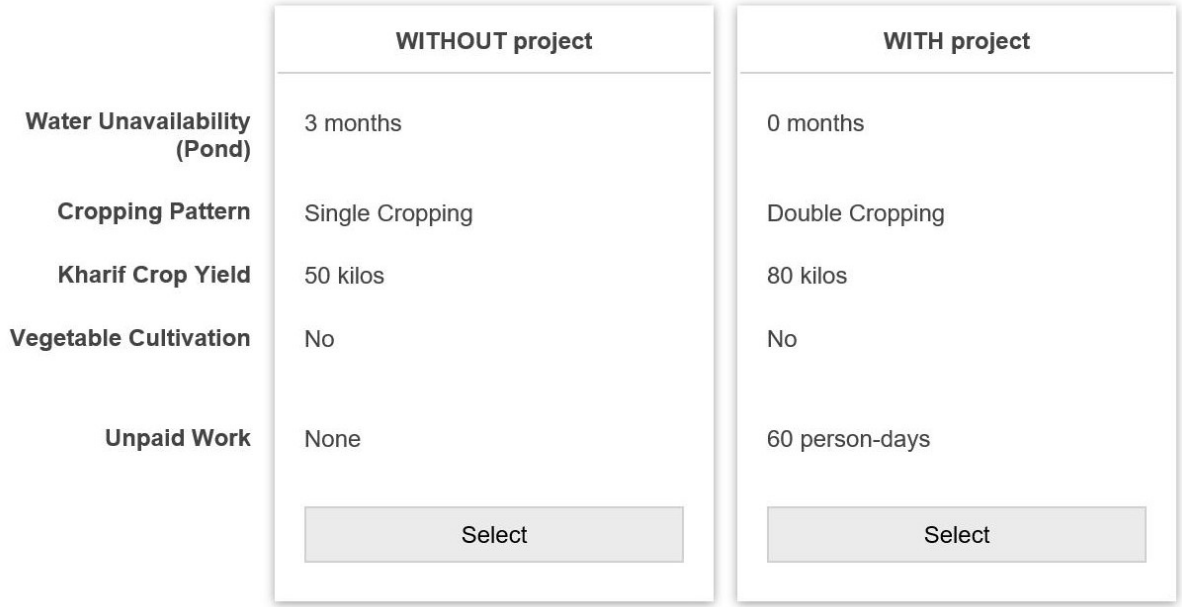
The fourth attribute, *VegNo* or *VegDouble*, is an effects coded variable indicating whether or not the household can cultivate vegetables (if they currently do *not* grow vegetables) or whether or not they can double their production (if they currently *do* grow vegetables). Only households who currently grow or have the ability to grow vegetables privately in kitchen gardens will be given choice task with *VegNo* or *VegDouble* included as an attribute. Respondents who cultivate vegetables as part of a self-help group will not be given choice tasks with *VegDouble* included as an attribute because the individual share of the production may not be proportional. Similarly, to avoid multicollinearity, respondents who cultivate vegetables on agricultural land will not be given choice tasks with *VegDouble* included as an attribute.

3.3. The Survey and Data

Two versions of the survey were designed and respondents were randomly assigned to one the two. The only difference between the two versions is the payment vehicle in the DCE (labour or money). Respondents were asked to imagine a hypothetical scenario in which an international NGO is about to design a project that can improve the availability of water in the village. In the money treatment, they were told that the project would not generate employment but that households would have to pay a one-off contribution in order to get access to the benefits of the project. In the labour treatment, respondents were told that the NGO would cover all material costs but that households would have to contribute manual labour for the project to be implemented. Respondents could only volunteer labour on behalf of themselves (i.e., respondents could not volunteer other members of the household to carry out the work).

Each respondent was presented with eight choice tasks asking them to choose between an improved hypothetical scenario (WITH project) at some cost (labour or money) and the current scenario (WITHOUT project) at zero costs. An example of a choice task with labour as the payment vehicle is shown in Figure 3.

Figure 3: Sample choice task with labour as payment vehicle



The experimental design of the attribute levels in the choice tasks was generated using the software Ngene (version 1.1.2). A pivot design was used where attribute levels in the *WITH project* alternative are pivoted around the respondent's current attributes levels that are displayed in the *WITHOUT project* alternative. The *WITHOUT project* alternative is thus respondent-specific but it does not change over the eight choice tasks. The *WITH project* alternative represents an upgraded scenario where at least one of the non-payment attributes have improved but this will come at some cost in the form of either money or labour contributions.

Summary statistics for the surveyed respondents and their households are presented in Table 2 for each of the two subsamples. There is no systematic difference between the two samples.

Table 2: Descriptive Statistics (Mean) by Payment Vehicle

	Labour Sample	Money Sample
gender (1 = female, 0 = male)	0.49	0.46
age	37	36
years of education	4.7	5.2
household size	9.5	9.4
scheduled tribe (1 = yes, 0 = no)	0.44	0.44
other backward caste (1 = yes, 0 = no)	0.35	0.38
migration (1 = yes, 0 = no)	0.16	0.17
land (acres owned)	1.6	1.7
daily wage rate	144	144
irrigation (1 = yes, 0 = no)	0.12	0.11
cropping (1 = double, 0 = single)	0.09	0.14
vegetable cultivation (1 = yes, 0 = no)	0.20	0.17
household head (1 = yes, 0 = no)	0.50	0.46
cattle (headcount)	2.2	2.4
buffalo (headcount)	0.4	0.4
poultry (headcount)	1.6	1.6
goats (headcount)	1.1	0.6

4. Theoretical Framework and Model Specification

The analysis of choice data from the DCE will be based on random utility theory. The conceptual foundation for random utility theory was developed by Louis L Thurstone. According to Thurstone (1927), "*an observer is not consistent in his comparative judgments from one occasion to the next*". Choice behaviour is therefore assumed to be stochastic and the utility U obtained by individual *n* of alternative *j* can be partitioned into a deterministic component $X_{njk}\beta$ and a random component ε_{nj} (McFadden, 1974).

$$U_{nj} = X_{njk}\beta + \varepsilon_{nj} \quad (1)$$

The deterministic component of the utility function in (1) is defined as a linear function of attributes accompanied by a set of preference parameters β indicating the desirability of the attributes (Hensher et al., 2015; Hole, 2006). X_{njk} therefore denotes

the attribute level of the k^{th} attribute relating to the j^{th} alternative plus any relevant interactions between x_{jk} and choice-specific or individual-specific characteristics.

Two basic attribute-based utility specifications are shown in (2) and (3) for the money sample and the labour sample, respectively. An alternative-specific constant for the status quo (ASC_{SQ}) is included to reflect any (dis)utility of this alternative. A statistically significant positive (negative) alternative specific constant for the status quo alternative suggests that respondents like (dislike) the current state of affairs independent of the attributes describing the alternative.

$$U_{nj} = \beta_1 Months_j + \beta_2 DoubleCrop_j + \beta_3 Yield_j + \beta_4 VegYes_j + \beta_5 VegDouble_j + \beta_6 Money_j + \beta_7 ASC_{SQ} + \varepsilon_{nj} \quad (2)$$

$$U_{nj} = \beta_1 Months_j + \beta_2 DoubleCrop_j + \beta_3 Yield_j + \beta_4 VegYes_j + \beta_5 VegDouble_j + \beta_6 Labour_j + \beta_7 ASC_{SQ} + \varepsilon_{nj} \quad (3)$$

The distribution of the error terms is unknown but a standard assumption in the literature is that they are independently and identically distributed following a type 1 extreme value distribution. This assumptions leads to the conditional logit model (McFadden, 1974) in which the probability of respondent *n* choosing alternative *i* is given by (4).

$$P_{ni} = \frac{\exp(\lambda X_{nik}\beta)}{\sum_{j=1}^{J} \exp(\lambda X_{njk}\beta)} \quad (4)$$

The scale parameter λ is inversely related to the variance of the idiosyncratic term ($\lambda=\pi/\sqrt{6var[\varepsilon]}$) but in most applications, including the conditional logit model, the error variance is assumed to be constant and λ is therefore normalised to 1. An alternative model is the heteroscedastic conditional logit model which allows for unequal error variance across individuals (Hensher et al., 1998; DeShazo and Fermo,

2002). This is illustrated in (5) where a subscript *n* has been added to the scale parameter.

$$P_{ni} = \frac{\exp(\lambda_n X_{nik}\beta)}{\sum_{j=1}^{J} \exp(\lambda_n X_{njk}\beta)} \quad (5)$$

The scale term is a function of individual-specific characteristics Z_n and parametrised as $\exp(Z_n\gamma)$ which ensures that λ_n always is positive and that (5) equals (4) when $\gamma=0$. The parameters β and γ are estimated using maximum likelihood methods.

The two models in (2) and (3) can be estimated separately to obtain estimates of willingness to pay and willingness to work. It is also possible to estimate a pooled model which will allow for comparison of the two payment vehicles. Pooling of the data requires information about how respondents value their labour contributions. Previous papers comparing willingness to pay and willingness to work have typically used a fraction of the wage rate to convert labour contributions into monetary contributions (the relevant literature is discussed in Section 2.1). This approach allows for estimation of a model with a single parameter for costs. A few papers have instead estimated an empirical value of contributed time by estimating a joint model with two cost variables – money and labour. The marginal disutility of labour relative to the marginal disutility of money provides an estimate of the implicit value of contributed time. A basic utility specification allowing for joint estimation of the preference parameters for money and labour is shown below.

$$\begin{aligned} U_{nj} = {} & \beta_1 \text{Months}_j + \beta_2 \text{DoubleCrop}_j + \beta_3 \text{Yield}_j + \beta_4 \text{VegYes}_j + \beta_5 \text{VegDouble}_j + \\ & \beta_6 \text{Money}_j + \beta_7 \text{Labour}_j + \beta_8 \text{ASC}_{SQ} + \varepsilon_{nj} \end{aligned} \quad (6)$$

Utility differences between the two payment vehicles can be tested by including a set of interaction terms between a dummy variable LPV (Labour as Payment Vehicle) and each of the attributes. LPV equals 1 if respondent *n* is in the work sample and 0 otherwise. If any of the interaction variables are statistically significant, either

individually or jointly, it means that utility differences between the two payment vehicles exist (Gibson et al., 2016).

5. Results

Results from conditional logit estimation of the pooled model in (6) are presented in Model 1 of Table 3. All the attributes related to water as well as the payment attributes are significant and with the expected signs. The alternative specific constant for the status quo is negative and significant (z-stat: -2.24) which means that respondents, on average, dislike their current situation. This is not surprising in areas where water is a scarce resource and households depend on water for their livelihoods.

A number of utility specifications were estimated to incorporate potential preference heterogeneity relating to characteristics of the respondents as well as to the choice setting. These results are presented in Model 2 of Table 3. Yield is the only attribute for which male and female respondents obtain different marginal utility. The negative sign of the parameter indicates that an increase in crop yield is more desirable for men than for women (z-stat: -1.88).

The LPV×Attribute interaction variables are insignificant indicating that there is no immediate effect of the payment vehicle on marginal utilities. In other words, it is possible to estimate a shadow value of time such that choice behaviour is statistically indistinguishable between the two samples. This result provides support for the use of a monetary payment vehicle in developing countries.

During the pilot study, it became clear that respondents are either reluctant to report their level of income or likely to underreport it. Education is therefore included in the model as a proxy for individual-level income. Interaction variables between each of the cost variables and education are positive and significant indicating that more educated people are less payment sensitive in terms of both money and labour. Education is included as a continuous variable (years of schooling) rather than a discrete variable because the continuous variable provides for a better model fit. The

choice is further justified by the fact that 38 percent of the sample has zero years of schooling so the baseline group is of significant size.

Table 3: Conditional Logit Estimation – Pooled Model

	Model 1	Model 2
Months	-0.186***	-0.211***
	(0.039)	(0.050)
DoubleCrop	0.202***	0.207***
	(0.045)	(0.059)
Yield	0.044***	0.039***
	(0.006)	(0.009)
Yield×Female		-0.024*
		(0.013)
VegNo	-0.547***	-0.411***
	(0.091)	(0.118)
VegDouble	0.483***	0.257*
	(0.106)	(0.145)
Money	-0.460***	-0.473***
	(0.023)	(0.044)
Labour	-0.026***	-0.040***
	(0.001)	(0.003)
Money×Female		-0.175***
		(0.043)
Labour×Female		0.007***
		(0.002)
Money×Education		0.011***
		(0.004)
Labour×Education		0.002***
		(0.000)
ASC_{SQ}	-0.284**	-0.383***
	(0.127)	(0.130)
LPV×Months		0.013
		(0.060)
LPV×DoubleCrop		0.012
		(0.076)
LPV×Yield		0.010
		(0.013)
LPV×VegNo		-0.150
		(0.147)
LPV×VegDouble		0.225
		(0.184)
Log Likelihood	-1738.968	-1686.174
Observations	3208	3208

Standard errors in parentheses
* p<0.10; ** p<0.05; *** p<0.01

The estimated parameter for the interaction between the monetary cost variable and a dummy variable equal to 1 if the respondent is female is negative and significant (z-stat: -4.05). This indicates that women are *more* payment sensitive compared to men when the payment vehicle is money. The corresponding parameter for the interaction between labour and a dummy variable for gender is positive and significant (z-stat: 3.25) indicating that women are *less* payment sensitive compared to men when the payment vehicle is labour. Except for yield, women therefore appear to be willing to work more than men while men appear to be willing to pay more than women for any marginal improvement. Men are for example willing to pay 437 rupees, on average, to move from single to double cropping while women, on average, are willing to pay only 319 rupees. However, while women are willing to work 6.3 days to move from single to double cropping, men are willing to work only 5.2 days. Estimates of marginal willingness to pay (WTP) and marginal willingness to work (WTW) are presented in Table 4. Please note that the estimates are for respondents with zero years of schooling.

Table 4: Marginal WTP (rupees) and WTW (days)

	WTP Male	WTP Female	WTW Male	WTW Female
Months	-446	-325	-5.3	-6.5
	(111)	(77)	(1.3)	(1.6)
DoubleCrop	437	319	5.2	6.3
	(124)	(89)	(1.6)	(1.9)
Yield (100 kg)	82	22	1.0	0.4
	(20)	(18)	(0.2)	(0.4)
VegNo	-869	-634	-10.3	-12.6
	(258)	(185)	(3.1)	(3.8)
VegDouble	543	396	6.5	7.9
	(310)	(225)	(3.7)	(4.5)

Standard errors in parentheses

Female respondents are generally willing to work more and pay less than male respondents which means that the estimated shadow value of time for women is going to be lower than that of men. The shadow value of time is estimated to be 84 rupees for the average uneducated male respondent and 50 rupees for the average

uneducated female respondent. A gender gap in the value of time is not surprising given that many women in rural areas are engaged primarily in unpaid housework activities. According to the World Bank[2], the labour force participation of the female population in India was 28.7 percent in 2017 while that of men was 81.7 percent. Women are therefore less likely to have access to household finances compared to men.

The estimates in Table 4 demonstrate high demand for water related infrastructure. In another exercise, respondents were asked to rank seven broad categories of permissible works under MGNREGA according to how beneficial their implementation would be to their household. Each respondent was asked to state at least their first and second priority. The results are presented in Table 5. As shown, more than 80% of the respondents selected work related to water (drinking water, irrigation work or water conservation) as their first priority while only 8% selected rural connectivity which is one of the most implemented works in MGNREGA.

Table 5: MGNREGA works – ranking

	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	No Rank
Rural Connectivity	8%	24%	16%	10%	1%	40%
Playgrounds	0%	3%	3%	1%	1%	91%
Drought Proofing	6%	5%	13%	6%	2%	67%
Land Development	4%	8%	9%	8%	8%	62%
Drinking Water	43%	22%	11%	3%	0%	21%
Irrigation Work	19%	14%	29%	6%	2%	30%
Water Conservation	20%	23%	16%	13%	6%	22%

To test for differences in error variance between gender and across different levels of education, a heteroscedastic conditional logit model is estimated. The results are presented in Table 6. All attributes continue to be significant and with the expected signs. The alternative specific constant for the status quo remains negative and significant and there are no gender differences in terms of marginal utility for any of the non-payment attributes – including yield. The impacts of gender and education on payment sensitivity are comparable to Model 2.

[2] http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators
Series: Labour force participation rate, female (% of female population ages 15-64) (ILO estimate)
Series: Labour force participation rate, male (% of male population ages 15-64) (ILO estimate)

Table 6: Heteroscedastic Conditional Logit Estimation – Pooled Model

	Model 3	Model 4
Months	-0.183***	-0.166***
	(0.045)	(0.036)
DoubleCrop	0.167***	0.153***
	(0.051)	(0.040)
Yield	0.020***	0.023***
	(0.007)	(0.006)
Yield×Female	-0.007	-0.008
	(0.012)	(0.011)
VegNo	-0.299***	-0.334***
	(0.106)	(0.087)
VegDouble	0.204*	0.255***
	(0.116)	(0.088)
Money	-0.422***	-0.414***
	(0.048)	(0.047)
Labour	-0.037***	-0.032***
	(0.004)	(0.004)
Money×Female	-0.192***	-0.185***
	(0.055)	(0.054)
Labour×Female	0.005**	0.004**
	(0.002)	(0.002)
Money×Education	0.016***	0.016***
	(0.003)	(0.003)
Labour×Education	0.002***	0.002***
	(0.000)	(0.000)
ASC SQ	-0.329***	-0.315***
	(0.111)	(0.103)
LPV×Months	-0.001	
	(0.050)	
LPV×DoubleCrop	0.005	
	(0.062)	
LPV×Yield	0.010	
	(0.010)	
LPV×VegNo	-0.138	
	(0.118)	
LPV×VegDouble	0.154	
	(0.143)	
Scale (γ)		
Female	-0.132	-0.124
	(0.117)	(0.117)
Educ	0.043***	0.044***
	(0.014)	(0.013)
LPV		0.157
		(0.106)
Log Likelihood	-1679.482	-1679.903
Observations	3208	3208

Standard errors in parentheses
* p<0.10; ** p<0.05; *** p<0.01

The estimated scale parameter for female respondents is negative but insignificantly different from zero (z-stat: -1.13). The scale for male respondents with zero years of schooling is normalised to one and the scale for female respondents with zero years of schooling can be computed as $\lambda_{female} = \exp(-1.32) = 0.88$. We fail to reject a hypothesis test of λ_{female} being equal to one (p-value: 0.227) which means that there is no significant difference in error variance across gender. The scale for educated respondents (independent of gender) increases by $\lambda_{educ} - 1 = \exp(0.043) - 1 = 0.04$ per extra year of schooling. A hypothesis test of λ_{educ} being equal to one is rejected (p-value: 0.002). This implies that more educated respondents make more deterministic choices compared to less educated respondents (the error variance is lower). Finally, Model 4 is estimated to test for scale heterogeneity between payment vehicles. It is hypothesised that respondents are more familiar with labour contributions and that the error variance for the labour sample therefore is lower than in the money sample. This hypothesis is rejected.

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