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What Do Respondents Bring to Contingent Valuation?

A Comparison of Monetary and Labor Payment Vehicles

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Abstract

With contingent valuation, both the goods being valued and the payment vehicles used to value them are mostly hypothetical. However, although numerous studies have examined the impact of experience with the good on willingness to pay, less attention has been given to experience with payment vehicles. This paper examines how this influences responses to a contingent valuation scenario of maintenance for irrigation canals. Specifically, the paper uses a split-sample survey to investigate the effects of experience with monetary and labor payment vehicles on the acceptance of a contingent valuation scenario and protest bids. Using convergent validity tests, we found that experience acquired from using both monetary and labor payment vehicles reduces the asymmetries in acceptance rates. These findings suggest that experience with payment vehicles reduces time/money response asymmetries in the contingent valuation method.

Key Words: contingent valuation, payment vehicles, numéraires, experience

JEL Classification: Q51, Q56

Contents

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Introduction

A recurrent finding from contingent valuation (CV) studies in developing countries is that respondents are more likely to state a positive willingness to pay (WTP) and a higher mean WTP when the valuation is based on a labor payment vehicle rather than a monetary payment vehicle (see Swallow and Woudyalew 1994; Echessah et al. 1997; Hung et al. 2007). The relatively higher acceptance rates for non-monetary payment numéraires have also been observed in revealed preferences (Lee et al. 1999) and in experimental settings (Ellingsen and Johannesson 2009). These variations in responses to CV surveys hinder pooling of CV data (Layton and Lee 2006) and, according to Diamond and Hausman (1994), also question the credibility of the contingent valuation method (CVM). Meanwhile, the attitude–behavior models (Fishbein and Ajzen 1975; Ajzen 1991) and the discovered preference hypothesis (Plott 1996) postulate that decision bias is reduced in repeated and familiar choice environments. Therefore, the time/money response asymmetry should decrease with experience and in familiar decisionmaking environments. This paper investigates the effects of experience with monetary and labor payment vehicles on the acceptance of CV scenarios and protest bids.

With the CVM, both environmental goods scenarios and payment vehicles are hypothetical. The hypothetical framing in CV studies creates discrepancies between actual and stated preferences. (See, e.g., Neill et al. 1994; Loomis et al. 1996; and List 2001.) This hypothetical bias remains a concern in the design and conduct of CV surveys and the use of the CV in public policy. However, a number of theories suggest that respondents with experience provide more realistic WTP responses in stated preferences. (See, e.g., Plott 1996; Bjornstad et al. 1997; and Kahneman and Sugden 2005).

According to Plott (1996), repeated decisions about WTP choices and feedback on the consequences of these decisions promotes institutional and value learning, in other words,

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discovering the features of one's own preferences. Thus, when respondents face new decisions, they may experience uncertainties that introduce a systematic bias. However, when these decisions are repeated, the uncertainties and consequent systematic biases are reduced. The attitude–behavior models of Fishbein and Ajzen (1975) and Ajzen (1991) arrived at similar conclusions. Furthermore, studies show that market experience attenuates hypothetical bias and reduces the willingness-to-accept–willingness-to-pay discrepancy in the CVM (List 2003). Therefore, familiarity with the decisionmaking environment addresses a number of anomalous behaviors.

Both the experimental and non-experimental literatures have analyzed how experience with environmental goods affects WTP values for them (e.g., Whitehead et al. 1995; Cameron and Englin 1997; Turpie 2003; Kniivila 2006; Carlsson and Martinsson 2008). These studies conclude that the welfare values for goods with which respondents have experience differ from the welfare values for goods with which they have no experience. However, although much attention has been given to the issue of how experience with the good being valued affects the respondent's WTP, considerably less attention has been given to the issue of whether experience with the payment vehicle matters in the CVM.

Payment vehicles play a crucial role in CV studies. Such vehicles provide a context for the payment, and their credibility has a major influence on convincing the respondents of the genuineness or frivolity of the survey. For this reason, most recommendations for the design and conduct of CV surveys postulate payment vehicles that are realistic and neutral. (See, e.g., Mitchell and Carson 1989; and Arrow et al. 1993.) As a result, a number of empirical studies assess the effect of payment vehicles on the WTP. For instance, Bergstrom et al. (2004) compared mean WTP for water quality protection in the United States under tax reallocation and special tax, and found that mean WTP under tax reallocation is higher than mean WTP under special tax. Wiser (2007) compared mandatory with voluntary payment vehicles used for valuing renewable energy among U.S. households. Wiser found higher mean WTP under mandatory payment mechanisms than under their voluntary equivalents.

In a related study, Ivehammar (2009) compared using a local tax as a payment vehicle with three other payment vehicles in the valuation of environmental externalities (so-called environmental encroachment) in road transportation in Sweden. She concluded, among other things, that payment vehicles influence the mean WTP. Using an open-ended CVM, Bateman et al. (1995) compared proportions of zero WTP bids under general donations, donations to a specific fund, and direct taxation. In the latter study, significant differences in the proportions of zero bids were observed among the three donation mechanisms. Thus, there is overwhelming evidence that the choice of payment vehicle influences both the level of WTP and the acceptance rates of a scenario. However, whether experience with the payment vehicle may itself have an impact remains to be investigated.

Different numéraires have been adopted in the elicitation of preferences in the CVM. The monetary numéraire, whereby the WTP for goods is stated in monetary units, is the most common for eliciting WTP. However, an increasing number of CV studies in developing countries have adopted non-monetary numéraires. Shyamsundar and Kramer (1996) used rice as the numéraire to estimate losses to rural households from tropical forest protection in Madagascar due to a limited cash economy among the respondents.

The respondents in a study may be more familiar with non-monetary numéraires in mobilizing resources for the provision of local public goods. For instance, users of a common-pool resource often mobilize labor and/or money to support management of the natural resource. For this reason, Swallow and Woudyalew (1994) and Echessah et al. (1997) adopted money and labor to value tsetse fly control in Kenya and Ethiopia, respectively. Similarly, Hung et al. (2007) elicit WTP values for forest fire prevention using labor and money in Vietnam.

Results from these studies indicate that a labor numéraire is associated with higher acceptance among respondents in comparison with a monetary numéraire. Moreover, using the average wage rate of a casual worker, Echessah et al. (1997) found that the mean WTP is higher under the labor payment vehicle than under the monetary payment vehicle. Eom and Larson (2006) argued that, theoretically, when choices are constrained by time and money, welfare values can be elicited using either numéraire. In addition to the theoretical model, these authors suggested that the higher acceptance rates and higher mean WTP for labor could be linked to a low valuation of time and hypothetical bias.

Two broad explanations exist for the higher acceptance rates under non-monetary payment vehicles in the CVM. The first holds that market imperfections may restrict the substitution among different resource endowments. For instance, liquidity constraints could compel respondents to adopt non-monetary payment vehicles rather than their monetary counterparts. The second explanation, the discovered preference hypothesis, suggests decay in decision biases in repeated-choice environments (see Braga and Starmer 2005). Therefore, in repeated-choice environments, the money/time asymmetry tends to disappear in the CVM.

Hung et al. (2007) argued that the acceptability of payment in workdays in the CVM may be due to prior use of such payments and, thus, offers a much more realistic payment vehicle. This has been the basis for adopting labor numéraires to elicit preferences in the CVM in developing countries (see Swallow and Woudyalew 1994; Echessah et al. 1997). While market imperfections may imply different mean WTP values, depending on payment vehicles, increased familiarity with the payment vehicles should reduce these differences according to the second explanation.

In this study, we evaluate the effects of experience with monetary and labor payment vehicles on responses to a CV scenario by comparing acceptance rates and protest bids of two

sub-samples. Respondents in one of the two sub-samples have experience with both monetary and labor payment vehicles, while respondents in the other sub-sample have used only the labor payment vehicle to mobilize resources to maintain common irrigation canals.

The paper is structured as follows. The next section describes the study area and how resources are mobilized to maintain the irrigation canals. Sections 2, 3, and 4 provide the analytical framework of the study, explain the CV scenario, and describe the sampling method, respectively. The fifth section presents the results from the study, while the conclusions are provided in the final section.

1. Afife Irrigation Project in Ghana

The 2008 *World Development Report* notes that the irrigation infrastructure in sub-Saharan African countries is inadequate. Only about 4 percent of total land in the region is irrigated (World Bank 2007). In addition, the existing infrastructure is poorly maintained, further reducing the actual percentage of land irrigated. Evidence of poor maintenance of irrigation dams and canals is manifest in eroded dam walls, blocked spillways, and siltation. The World Bank (2007) also noted that the operation and maintenance of public irrigation systems remain a problem in many developing countries. Public irrigation systems suffer from chronic underinvestment in maintenance. Even in countries where farmers are charged with operation and maintenance costs, most fees are not collected and most farmers do not pay them. Thus, improved management of the poorly working irrigation canals in sub-Saharan African countries is imperative.

Devolution is a common mandate for managing common-pool resources, where such policies require resource users to make monetary and non-monetary sacrifices to support participatory resource management. The devolution of resource management in Ghana has been an integral part of decentralizing governance, according to the Ghanaian government's structural adjustment program and the Ministry of Food and Agriculture's "Accelerated Agricultural Growth and Development Strategy," since the 1980s (Ofori 2000). In the early 1990s, the government introduced participatory irrigation management programs, which transferred responsibility for the maintenance of irrigation canals from the central government to local governments and farmers.

Among the many projects promoting irrigation farming in Ghana is the Afife irrigation project. With technical assistance from China, a dam was constructed in 1983 to irrigate more than 1,000 hectares of plots for rice production. It is a gravity-type irrigation system, which depends on maintaining the canals that supply the irrigation water. The plots supported by the Afife irrigation are divided into 11 sections of about 100 hectares each. These were allocated to about 2,000 peasant households. Currently, the project falls under the Ghana Irrigation Development Authority.

When the project began in 1983, the Ghanaian government maintained the canals, employing workers to properly maintain them. However, after 1990, when this responsibility was transferred to the farmers, they had to mobilize the labor to work on the canals. However, the canals have not been properly kept up under the local management regime, reflected by the increased siltation in the canals.

Under the current management, which started in 1997–2000, farmers in Afife irrigation sections 1–8 switched to contributing money for the maintenance of the canals. They contribute about GHS 3[1] or output equivalents per hectare per season to finance the canals' maintenance. However, farmers in sections 9–11 continued to mobilize labor time of about 3 hours per season to maintain the canals. According to the extension officers, each section has its own leaders who decide whether to adopt monetary or labor contributions to finance canal maintenance in a specific section, based on their personal preferences.

2. Theoretical Model

Two different comparisons were made in the present study: between monetary and non-monetary payment vehicles, and between experience and no experience with a certain payment vehicle. These comparisons were made for a CV scenario for the mobilization of resources among users of a common-pool resource. The welfare estimates for the change in environmental goods (i.e., maintenance of the irrigation canals) are elicited in both monetary and non-monetary (i.e., labor) payment vehicles. The welfare estimate for the improvement of the quality of irrigation canals when the monetary payment vehicle is used is:

$$V_m\left(y - WTP_m, \mathbf{p}, q_1; Z\right) = V_m\left(y, \mathbf{p}, q_0; Z\right), \tag{1}$$

where $V_m(\square)$ is the indirect utility function; y is the income; q_0 is the existing quality of the irrigation canals; q_1 is the improved quality of the irrigation canals and $q_1 > q_0$; WTP_m is the willingness to pay for the improvement in irrigation canals elicited in monetary units; $\mathbf{p}$ is the vector of prices; and Z denotes socioeconomic variables.

Similarly, labor time can be mobilized to provide for change in the environmental quality. Since time is an economic resource, the value of environmental change can be expressed in terms of the value of time. Following the theoretical model devised by Eom and Larson (2006), we can derive WTP for maintenance of the irrigation facility using labor as the numéraire (WTP_l), as follows:

$$V_l\left(l^f - WTP_l, \mathbf{p}^\mathbf{f}, q_1; Z\right) = V_l\left(l^f, \mathbf{p}^\mathbf{f}, q_0; Z\right), \tag{2}$$

[1] GHS = Ghana cedi. GHS 3 = about US$ 2, at the time of the survey in 2009.

where $V_l(\square)$ is the indirect utility function; WTP_l is the willingness to pay for the improvement in the irrigation facility elicited in labor units; l^f is the full budget; $\mathbf{p}^{\mathbf{f}}$ is the vector of full prices; q_0 is the existing quality of the irrigation canals; q_1 is the improved quality of the irrigation infrastructure and $q_1 > q_0$; and Z denotes socioeconomic variables.

The notion of full budget (or price) combines income (or price) and time endowments. Note that the full budget and full prices can be stated in either monetary or non-monetary units (see Eom and Larson 2006). In this case, the full budget and full prices are stated in labor units.

The extensive adoption of labor to provide common-pool resources in developing countries has permitted researchers to conduct CV studies using labor as the payment vehicle. These include Swallow and Woudyalew's (1994) and Echessah et al.'s (1997) studies to value tsetse fly control in Ethiopia and Kenya, respectively, and Hung et al.'s (2007) work on fire prevention in Vietnam. These studies also compare the responses under labor and monetary payment vehicles. Their findings indicate that the acceptance rates are higher under labor payment vehicles than under their monetary payment counterparts. Echessah et al. (1997) also compared mean WTP under the two payment vehicles. Their conclusions indicated that mean WTP is higher under the labor than the monetary payment vehicle. However, the effects of the choice of payment vehicles on protest bids were not presented in these studies.

In the context of the CVM, a number of theories can explain behavior or response. The discovered preference hypothesis suggests changes in responses to WTP questions. According to Plott (1996), rational choices go through three stages, with decreasing levels of error in the decisionmaking. In stage 1, where experience is completely absent in the choice environment, responses are impulsive and make little sense. However, stages 2 and 3 involve repeated choices and, as a result, incorporate awareness and experience. Choices in stages 2 and 3 approach rational ones. Therefore, there is institutional and value learning in choices (Braga and Starmer 2005). Whereas *institutional learning* enables one to learn how to avoid errors, *value learning* offers an agent the environment to learn about one's preferences.

Similarly, attitude–behavior models in the social psychology of Fishbein and Ajzen (1975) and Ajzen (1991) offer explanations on the motives behind planned behavior, and Spash et al. (2009) related these attitude–behavior models to responses in the CVM. For instance, Fishbein and Ajzen (1975) discussed how correspondence, proximity, and familiarity criteria influence the degree of association between attitudes or intentions and behavior. The greater the correspondence between attitude and intention, the closer the behavior will be to the intention. Also, the proximity criterion concludes that if the intervening stages between a component in a model and behavior are few, then the predictive power of that component should be higher. Finally, the familiarity condition states that, the

more familiar an agent is with a specific behavior, the greater the predictive power of the agent's attitude in respect of his/her behavior.

A number of studies use the CVM to investigate how experience and access to more information affects WTP. Some of these studies conclude that experience with the goods or giving respondents more information about the goods increases the mean WTP (e.g., Whitehead et al. 1995; Cameron and Englin 1997; Turpie 2003; Kniivila 2006; Carlsson and Martinsson 2008), and giving respondents time to think about the CV scenario enables them to submit lower bids for the scenarios offered (Whittington et al. 1992). The conclusions of these studies indicate that provision of information and time, and having previous experience with the good matters in CVM.

Market imperfections affect both the probability of accepting a CV scenario and the value of the WTP. Under market imperfections, one resource endowment cannot easily be converted into another, and different payment vehicles will exhibit different probabilities of accepting the CV scenario, leading to different WTP values. The market imperfections argument indicates that the results from the conduct of CV will depend on the resource endowment—and, for that matter, the payment vehicle. Different payment vehicles can provide a different total WTP for environmental goods. In terms of devolution policies, this also implies that different methods of involving resource users will yield different outcomes.

In our context, the respondents have varying degrees of experience with two payment vehicles, namely, monetary and labor. The CV scenario itself is fairly tangible, the study area is well served by transport and market networks, and credit constraints are limited and fairly uniform in the study area. These permit us to isolate the effects of experience from other effects.

3. Estimation Strategy

This study principally compares the two sub-samples in terms of the convergence of the responses to the CV scenario under the two payment vehicles. Thus, we perform convergent validity tests on acceptance rates and protest bids between monetary and labor payment vehicles. This is done for the respondents who have experience with both payment vehicles, and for those who used the labor payment vehicle only. The convergent validity approach can be adopted only when measurements of phenomena are available using two different techniques (Carson et al. 2001).

In addition to the convergent validity tests, we estimated bid curves. Bid curves provide a statistical relationship between WTP and a set of independent variables. For the open-ended CVM, bid curves can be estimated for several reasons (Alvarez-Farizo et al. 1999). One reason is theoretical validity in which the expected signs of the independent variables are compared with a priori expectations. The statistical relationships can also be

estimated as a test of discriminant validity, in other words, whether or not a statistical relationship that is explained by variations in the independent variables exists. Bid curves can also be used for value transfers, whereby the estimates estimated for a study are used in a different context.

The econometric model presented in this section follows Tobin (1958). The linear regression model for the bid function is specified as:

$$y_{ij} = \mathbf{x}_i\boldsymbol{\beta} + \varepsilon_i; \qquad j = l, m, \tag{3}$$

where $y_i = WTP_i$ represents the *i*th respondent's willingness to pay for improved maintenance of irrigation canals, $\mathbf{x}_i$ is a vector of independent variables, $\boldsymbol{\beta}$ is the vector of parameters to be estimated, and ε_i is error term. The subscript j denotes the payment vehicle used in the preference elicitation, with l indicating that WTP was elicited under the labor payment vehicle, and m indicating its elicitation under the monetary payment vehicle.

For a sample of *n* independent observations, the censored maximum likelihood estimator (MLE) maximizes the log-likelihood function for censoring from below (see Cameron and Trivedi 2005):

$$\ln L(\boldsymbol{\theta}) = \sum_{i=1}^{N}\left(d_i \ln f\left(y_i \mid \mathbf{x_i}, \boldsymbol{\theta}\right) + \left(1 - d_i\right)\ln F\left(L_i \mid \mathbf{x_i}, \boldsymbol{\theta}\right)\right), \tag{4}$$

where $\boldsymbol{\theta}$ are the parameters of the distribution of y_i; and d_i is an indicator variable, which assumes the value of 1 if $y_i > 0$, and 0 if $y_i = 0$. Note that, in this instance, the lower bound is zero (i.e., $L = 0$). The $f(\square)$ is the conditional probability density function, while $F(\square)$ is the cumulative density function. Depending on the correct specification of $f^*\left(y_i \mid \mathbf{x_i}, \boldsymbol{\theta}\right)$, the censored MLE is consistent and asymptotically normal (Cameron and Trivedi 2005). We followed the existing studies with regard to the specification of $f^*\left(y_i \mid \mathbf{x_i}, \boldsymbol{\theta}\right)$ and selected the independent variables based on previous studies (e.g., Swallow and Woudyalew 1994; Echessah et al. 1997; Köhlin and Amacher 2005; Hung et al. 2007, and Barton and Bergland 2010).

4. Data

Our study conducts a CV study among farmers at the Afife irrigation project in Ghana where monetary and labor payment vehicles are used to maintain irrigation canals. In the present set up, some of the farmers contribute labor towards maintaining the canal, while the others contribute money or its output equivalent. The farmers using money previously used labor, but switched to money or output equivalent instead. Thus, each farmer participates in only one scheme for maintaining irrigation canals.

In a 2x2 factorial design, the study compares monetary and labor payment vehicles among sub-samples: those which have used both payment vehicles, and those which have used only labor payment. Therefore, labor and monetary payment vehicles were employed to value the maintenance of irrigation canals among the respondents who currently pay in labor and those who once used labor but have now transferred to money as a payment vehicle. Within this framework, we will be able to compare the acceptance rates and protest bids under the two payment vehicles between the two sub-samples.

To value the preferences for the maintenance of the irrigation canals, we propose to restore the quality and maintenance of irrigation canals to the level that existed until 1990, when the Ghanaian government provided resources for such maintenance.

More than 40 percent of the farmers in the sample have farmed since 1990. The canal carries water from the dam into lateral and sub-lateral channels, which supplies rice farmers with water for their plots. The proposed change requires farmers to contribute labor or money to maintain the canals. The change also aims to ensure compliance with rules and regulations designed by farmers for maintaining the canals. The change is sufficient to halt the degradation of the canals and restore their quality to the level enjoyed when the government employed workers to maintain the irrigation system. This CV scenario is unique in the sense that the respondents have good practical knowledge of it. That is, the good valued in the study is clear and practical, and the respondents know the quality they can expect under a more effective canal management system.

The data for the analyses was collected through a survey of smallholder rice farmers who benefited from Afife irrigation project from February to May 2010. We interviewed a random sample of 550 farmers, using a stratified sampling technique in which respondents were sampled from each of the 11 sections, as well as from towns and villages in the study area. Each farmer was given the questionnaire in a face-to-face interview during the minor farming season. Of the total sample of 550, only two people refused to participate in the survey. This gave us a participation rate of over 99 percent.

The questionnaire included questions about socioeconomic variables, such as the farmers' age and marital status; the number, age and gender of any dependents; farming experience; the characteristics of the plots; total investment in soil and water conservation; fertilizer adoption; and current participation in jointly maintaining the irrigation canals. To determine the individual discount rate, each farmer was presented with two hypothetical work programs and was asked to choose one. Option A rewarded a farmer with GHS 150 in a month's time, while option B paid the farmer GHS 200 in six months' time. The farmers were also asked to quote a value for option B that would make them indifferent to either program.

The farmer's discount rate is then calculated as $\delta = \log\left(\frac{\eta_2}{\eta_1}\right)$, where η_2 is the value indicated by the farmer and η_1 is the value of option A (GHS 150). Thus, if a respondent is indifferent to both options A and B, it implies an individual discount rate of about 33 percent per season. Currently, the moneylenders charge farmers a rate of 50 percent per season. Finally, we also used the replacement value method to estimate each farmer's total household wealth.

4.1 The Contingent Valuation Scenario

The CV scenario starts with a general discussion of the difficulties involved in maintaining irrigation canals. It highlights the breakdown of irrigation systems throughout the country, attributed to the lack of maintenance and clearing of the canals. Farmers generally assume other farmers will provide resources for canal maintenance and shirk their own responsibility for it. This often results in a situation where nobody maintains the canals. In addition, government funds are scarce and too little is designated for canal maintenance.

In the CV scenario, a new 10-year management plan is proposed in order to restore the maintenance of irrigation canals. By requiring farmers to contribute money or labor each year, the new management system should halt the canals' degradation and ensure that irrigation water reaches all the farmers' plots. Implementation depends on the respondents' monetary or labor contributions, as well as those from other farmers. If the majority of the farmers support the plan, it will be implemented, and all farmers will have to make their annual monetary or non-monetary contributions for 10 years. Assuming that the new management plan mobilizes enough resources, it should adequately improve the current system. Also, because of its mandatory nature, free riding will be curtailed. From the descriptions above, we offered the respondents a choice between the present situation (q_0) and the quality that existed until 1990(q_1).

4.2 Payment Vehicles

Two versions of the questionnaire were designed, one for each of the two payment vehicles. One questionnaire dealt with payments made in money and the other with payments made in labor. In both versions of the questionnaire, we used an open-ended CV format to elicit WTP. We opted for the open-ended CV format because, in close-knit communities, information about surveys and the choices they cite moves quickly among community members. Giving different choices to different respondents could distort the responses (Whittington 1998).

The payment vehicles are described as mandatory because the voluntary payment mechanism in CV surveys does not resolve the difference between contingent valuation and actual payment (Hanemann 1994; Veisten and Navrud 2006). In addition, the voluntary

payment mechanism is subject to free-riding behavior. Furthermore, we adopted a 10-year planning horizon for both versions of the questionnaire in order to make the scenario credible.

5. Results

The composition of the sample is presented in table 1. Of the 548 respondents, 348 currently use the monetary payment vehicle to maintain the irrigation canals. Because this sub-sample had used the labor payment vehicle in the past, they were familiar with both payment vehicles. We interviewed a total of 246 respondents from this sub-sample using the monetary-payment-vehicle version of the questionnaire, and interviewed 102 respondents with the labor payment alternative. Of the remaining 200 respondents—who currently use and previously used the labor payment vehicle to maintain the canals—44 were interviewed using the monetary-payment-vehicle questionnaire, and 156 were interviewed with the labor-payment counterpart.

Table 1. Composition of the Sample

Payment vehicles	WTP in money	WTP in labor	Total
Currently use money	246	102	348
Currently use labor	44	156	200
Total	***290***	***258***	***548***

Table 2 presents the description of variables and their means, as well as the test of mean differences of the data. The descriptive statistics are presented for farmers who use either the monetary payment vehicle (MPV) or the labor payment vehicle (LPV) to maintain the irrigation canals. Under each of these sub-samples, the table also presents separate summary statistics for those interviewed with the two versions of the questionnaires.

The findings show that the farmers are on average 46 years old, head a household with an average of 5.33 persons, and work a plot averaging 2 hectares. Leaseholders constitute about 8 percent of the total sample. The leaseholders acquire their plots from owners for a given duration and are responsible for the canal maintenance during the tenure of the lease agreement. The subjects under consideration are small-scale farmers.

As part of the survey, we asked extension officers to rank the level of soil fertility, the degree of slope, the soil type, and the degree of erosion on the plots we sampled. On a scale of 1 to 10, where 1 represents the lowest and 10 the highest, the average slope was about 3, indicating that the plots are fairly level. As a result, the degree of erosion is also quite low, namely, an average of 2.21 on the 1–10 scale. The average distance between the town or village of residence and the plot in question measured about 4.18 km.

The Ghanaian government has also implemented a fertilizer subsidy program since 2007, so we captured the participation in this subsidy scheme as well. About 40 percent of the total respondents benefit from the national subsidy program. Fertilizer intensity is about 300 kg per hectare.

Table 2. Description of Variables, Means, and Test of Mean Differences

Variables	Description	Currently using MPV				Currently using LPV			
		MPV	***LPV***	***Diff***	***Pooled***	***MPV***	***LPV***	***Diff***	***Pooled***
Independent variables									
Age	Age of the farmer (in years)	45.920	45.270	0.650	45.666	47.819	47.197	0.623	47.624
Gender	Dummy variable for farmer's gender (1 = male)	0.752	0.775	-0.023	0.761	0.776	0.629	0.147**	0.730
Household size	Number of household members	5.301	5.426	-0.126	5.350	5.239	5.308	5.459	5.308
Alternative employment	Respondent has alternative employment (1 = yes)	0.552	0.558	-0.006	0.555	0.530	0.606	-0.076	0.554
Discount rate	Discount rate	0.565	0.560	0.005	0.560	0.550	0.640	-0.09**	0.580
Plot size	Plot size (in hectares)	1.984	1.996	-0.012	1.989	2.108	1.960	0.148	2.059
Plot location	Plot location on distributary canal (tail = 1, middle/head = 0)	0.299	0.258	0.041	0.283	0.315	0.356	-0.041	0.328
Fertilizer	Number of fertilizer bags used per hectare	5.916	5.254	0.662**	5.656	6.052	6.290	-0.238	6.127
Leasehold	Dummy for leasehold (1 = farmer leases plot)	0.089	0.087	0.002	0.088	0.089	0.048	0.041	0.076
Distance	Distance from where the farmer lives to the plot (in km)	4.230	4.379	-0.149	4.288	4.075	3.814	0.261	3.996
Erosion	Level of erosion on 1 to 10 scale (1 = lowest)	2.325	2.500	-0.175**	2.392	1.854	1.914	-0.060	1.873
Marital status	Dummy variable for marital status (1 = married)	0.883	0.877	0.006	0.881	0.903	0.903	-0.000	0.903
Wealth	Total wealth of the farmer's household (in GHS)	4,918.45	3,881.82	1,036.63	4,512.16	7,000.45	3,161.64	3,838.81**	5,793.40
Current money payment	Annual contributions towards maintenance of canals (in GHS)				6				0
Current labor payment	Annual contributions towards maintenance of canals (in hours)				0				6

Dependent variables									
WTP (in money)	WTP elicited in monetary units (GHS) per hectare per year	13.974			13.974	14.590			14.590
WTP (in labor)	WTP elicited in labor hours per hectare per year		14.750		14.750		16.765		16.765
WTP with minimum wage	WTP elicited in labor, converted to GHS using minimum wage	13.442	5.687	7.755***	10.335	14.223	6.517	7.705*	11.911
WTP with sample wage	WTP elicited in labor, converted to GHS using sample wage	13.442	13.753	-0.310	13.566	14.223	15.759	-1.536	14.683

Statistical significance: * = 10 percent, ** = 5%, and *** = 1%.

Among those who pay, the mean WTP is GHS 14.22 for the monetary payment vehicle and 15.34 hours per hectare per year for the non-monetary payment vehicle. These values for the WTP are substantially higher than current level of contributions towards canal maintenance, namely, GHS 6 for money contributions, and six hours per hectare per year for labor contributions.

The two sub-samples—the farmers who currently use the MPV and those who use the LPV—are very similar. The sub-sample pooled means are almost identical. With regard to the sub-sample that currently uses the MPV to maintain the canal, the mean differences for fertilizer use and level of erosion are statistically significant (i.e., $p < 0.05$). These indicate that fertilizer use is higher among the farmers who were given the MPV version of the questionnaire. Also, the degree of erosion is higher among the farmers who were interviewed with the LPV questionnaire. However, among the farmers who are currently using LPV to maintain irrigation canals, the mean differences of gender, discount rate and total household wealth are statistically significant (i.e., $p < 0.05$).

The extrapolated average discount rate per six months among those farmers using the MPV and LPV for canal maintenance is 56 percent and 58 percent, respectively. These discount rates are comparable to the seasonal interest rate of 50 percent, which the moneylenders charge for loans per season. Studies that estimate the rate of time preference in developing countries consistently report high individual discount rates. (See, e.g., Holden et al. 1998.)

There is no standard method for converting WTP or preferences for the maintenance of irrigation canals elicited under the MPV and LPV. Among farmers using the MPV to maintain canals, the monetary WTP is GHS 13.97 per hectare per year, while the labor WTP is 14.75 hours per hectare per year. Using Ghana's minimum wage to convert the WTP computed under the LPV, we found that the mean difference between monetary WTP and labor WTP is statistically significant (i.e., $p < 0.01$). This means that WTP estimated under the MPV is higher than that computed under the LPV.

However, this mean difference is not statistically significant when we use the mean wage rate of hired labor (i.e., the farmers' reported mean hourly costs for hiring laborers) to convert the labor WTP. For farmers using the LPV to maintain the canal, the mean WTP is GHS 14.59 under the MPV, and 16.76 hours under the LPV. The mean difference in WTP between the MPV and LPV is statistically significant when Ghana's minimum wage is adopted to convert the hours into monetary units (i.e., $p < 0.1$). This result indicates that WTP is higher under the MPV than

under the LPV, but when one applies the farmers' mean wage for hiring laborers, the difference in mean WTP under the two payment vehicles is not statistically significant.

The degree to which respondents accept the scenario is an important criterion for judging the overall performance of the CV survey. There was significant support among the respondents in respect of improving the irrigation canals. Overall, 92 percent (548 – 55 = 493) of the respondents supported the scenario by stating a positive WTP; in other words, they accepted the scenario. For the monetary version, the acceptance rate was 90 percent, while the corresponding figure for the labor input contribution was 95 percent. The high acceptance rates for the CV scenarios may also indicate farmers' dissatisfaction with the current state of irrigation canals.

During the survey, we explored the reasons for zero WTP bids. Of the 55 respondents, 19 motivated the zero WTP by stating either that other farmers would not contribute or that they believed that the government would not use the resources as intended. These are classified as *protest* responses. In addition, 15 respondents indicated a lack of resources to contribute. The remaining 21 wanted to change the payment vehicle: 14 of them wanted to change it from labor to money, while 7 of them wanted to change it from money to labor.

We also explored the potential differences in mean WTP for the monetary and non-monetary payment vehicles. The results are presented in table 3. First, we adopted Ghana's legislated minimum wage to convert the WTP elicited in labor units into monetary units. The mean WTP for the MPV came to GHS 13.75, while GHS 5.93 was registered for the LPV.

Table 3. Convergent Validity Tests between Monetary and Labor Payment Vehicles

Hypotheses	Monetary	Labor	Difference
Equality of proportions accepting scenario by payment vehicle	0.905	0.955	-0.049**
Equality of mean WTP by payment vehicle using minimum wage	13.749	5.931	7.818***
Equality of mean WTP by payment vehicle using sample wage	13.749	14.340	-0.592

Statistical significance: ** = 5%, and *** = 1%.

The difference between the two means is statistically significant (i.e., $p < 0.01$). However, if we use the rice farmers' wage rate for hired labor in our sample, the mean WTP for the LPV is GHS 14.34, which is not statistically different from the GHS 13.75 registered for the MPV.

Approximately 40 percent of the respondents benefit from the government's fertilizer subsidy program, which could make them more benevolent towards the CV scenario. Hence, we tested whether those who benefitted from the subsidy program were more likely to accept the CV scenario we designed for improving the management of the irrigation facilities. The results indicate that participation in the subsidy program had no statistically significant effect on the acceptance rates for the new management plan.

Table 4 provides further analyses of the acceptance rates and protest responses for the MPV and LPV under both sub-samples. These results indicate that, for the sub-sample which had experience using both payment vehicles to maintain irrigation canals, the acceptance rates of the CV scenario does not differ between those who were interviewed with the MPV and LPV versions of the questionnaire. However, for to the sub-sample who only used the LPV to maintain irrigation canals, the difference in proportions of who accepted the CV scenario under the two payment vehicles is statistically significant (i.e., $p < 0.1$). This finding indicates that the acceptance rate is similar for both payment vehicles if respondents have experience with both, but is different when the respondents have experience with only one of the payment vehicles.

Table 4. Convergent Validity Tests for Experience with Payment Vehicles

	Acceptance rates			Protest responses		
	WTP in money	***WTP in labor***	***Difference***	***WTP in money***	***WTP in labor***	***Difference***
Currently use MPV	0.897	0.942	-0.044	0.070	0.037	0.033
Currently use LPV	0.918	0.984	-0.066*	0.052	0.016	0.036

Statistical significance: * = 10 percent.

With regard to the protest behavior, there are no differences in the proportions of protest responses among farmers who were interviewed either with the MPV or the LPV questionnaire in the respective sub-samples. These results indicate that experience with payment vehicles reduces time/money response asymmetries.

As indicated earlier, market imperfections can also create disparities among acceptance rates and mean WTP under different payment vehicles. Holden et al. (1998) argued that market imperfections lead to variations in the rate of time preference. Hence, we compared the two sub-samples in terms of the extrapolated individual discount rates. The result indicates that the difference between the discount rates among farmers who have experience with both payment

vehicles and those who use only the LPV is not statistically significant. The differences in wage rates, wealth, household size, and plot size for the sub-samples are also not statistically significant. These conclusions indicate that the farmers were behaving under similar market environments. Thus, the earlier finding with regard to time/money response asymmetries can be linked to experience with payment vehicles.

The maximum likelihood estimation results using the Tobit model is presented in table 5. The dependent variables for models 1 and 3 are WTP stated in monetary units (GHS) and those of models 2 and 4 are WTP stated in labor units (hours). In order to be able to compute the natural logarithm of zero bids, all the dependent variables' values are computed as $\log(WTP_i + 1)$. The likelihood ratio indicates that specifications as a whole are statistically significant in all four model specifications. Therefore, we reject the null hypothesis that the coefficients for all the independent variables are simultaneously equal to zero in all model specifications.

Table 5. Regression Results

Independent variables	Currently use MPV		Currently use LPV	
	WTP in money (model 1)	***WTP in labor (model 2)***	***WTP in money (model 3)***	***WTP in labor (model 4)***
Discount rate	-0.370	0.713***	-0.954**	0.380
	(0.35)	(0.27)	(0.43)	(0.31)
Logarithm of age	-0.194	0.448*	0.344	0.300
	(0.33)	(0.23)	(0.46)	(0.28)
Gender	-0.124	0.119	0.327	0.354**
	(0.22)	(0.15)	(0.22)	(0.16)
Location of main distributary canal (tail end)	0.380*	0.303**	0.600***	0.173
	(0.20)	(0.14)	(0.20)	(0.14)
Logarithm of household size	0.399	-0.065	-0.174	-0.757***
	(0.26)	(0.20)	(0.34)	(0.20)
Logarithm of distance between plot and place of residence	0.120	-0.036	0.208	-0.142
	(0.17)	(0.14)	(0.27)	(0.15)
Leasehold	0.250	-0.375*	1.221**	0.170
	(0.31)	(0.22)	(0.47)	(0.25)
Logarithm of plot size	0.671*	-0.334	-0.239	-0.482**
	(0.36)	(0.27)	(0.39)	(0.22)
Logarithm of fertilizer	-0.077	0.230	-0.244	0.493***

use	(0.21)	(0.14)	(0.27)	(0.18)
Logarithm of total household wealth	-0.172**	0.026	-0.213***	-0.008
	(0.07)	(0.04)	(0.07)	(0.05)
Alternative employment	0.502***	-0.164	0.757***	0.198
	(0.19)	(0.14)	(0.21)	(0.13)
Constant	2.863*	0.170	2.660	1.661
	(1.50)	(1.00)	(1.76)	(1.05)
McFadden's *R square*	0.0884	0.0757	0.3784	0.1521
Number of observations	98	137	42	92
Likelihood ratio test $\chi^2(13)$	23.797***	24.373**	42.882***	29.915***

Models 1 and 2 show the results for the farmers who currently use the MPV to maintain irrigation canals. Whereas model 1 provides the results for respondents interviewed using the MPV version of the questionnaire, model 2 presents the results for respondents interviewed using the LPV version. The location of plots is significant in both models. Farmers whose plots are located at the tail end of the distributary canal indicate higher WTP for canal maintenance. Barton and Bergland (2010) arrived at the same conclusion in their study on farmers in India. Farmers with alternative employment indicate higher WTP to maintain irrigation canals under model 1. Similarly, farmers with relatively bigger plot sizes indicate a higher WTP for canal maintenance. Total household wealth is, however, negatively associated with WTP for canal maintenance in model 1.

With regard to model 2, farmers who lease their plots are less willing to pay for the maintenance of irrigation canals. This is also intuitive, since the leasehold is for a limited period: the incentive for improving the quality of irrigation infrastructure is therefore attenuated. This result supports the theoretical model devised by Yoder et al. (2008) on contract duration and investment in soil conservation, which suggests that, in comparison with their landlords, tenants invest less in soil conservation.

In model 2, the age of the farmer and the discount rate are also statistically significant. These results indicate that farmers with higher discount rates state a higher WTP in labor hours for the maintenance of canals.

Models 3 and 4 are the regression results for farmers who use the LPV to maintain irrigation canals: model 3 for those interviewed with the MPV version of the questionnaire, and

model 4 for those given the LPV version. In model 3, the discount rate is negatively associated with monetary contributions towards the maintenance of irrigation canals. Holden et al.'s (1998) study in three different developing countries in Africa and Asia found that households with immediate cash needs had higher rates of time preference; our results are in line with this finding. Also, the farmers whose plots are located at the tail end of the distributary canal stated a higher monetary WTP. Furthermore, farmers with leasehold contracts and alternative employment indicated higher monetary WTP, while household wealth is negatively associated with monetary WTP.

With regard to model 4, male farmers are likely to contribute labor hours for the maintenance of irrigation canals. Fertilizer use also increases with a farmer's willingness to contribute labor to maintain the canals. However, household size and plot size are negatively associated with labor contributions towards canal maintenance. In terms of comparisons of regression results under the same payment vehicle, we pooled the data together and ran regressions for both payment vehicles separately, with dummy variables for experiencing both payment vehicles. These dummy variables are not statistically significant in either model, indicating that model 1 is similar to model 3, and model 2 is similar to model 4.

6. Conclusion

The main purpose of this study is to investigate the effect of experience with monetary and labor payment vehicles on the relative acceptance of CV scenarios and protest bids in terms of these two payment vehicles. A split-sample survey was designed for this purpose. We used convergent validity tests to evaluate how experience affected potential differences in the farmers' willingness to pay for maintaining the irrigation canals that fed their plots. The results indicate that there is an asymmetry in acceptance rates between the two payment vehicles (although not in the rate of protest bids) when respondents only have experience with one of the vehicles. However, this asymmetry disappears when respondents have experience with both payment vehicles.

These results suggest that being familiar with monetary and labor payment vehicles attenuates time/money response asymmetry in the CVM. The study has implications for the conduct of the CVM and devolution policies in developing countries. In terms of the conduct of the CVM, these results suggest that the payment vehicles we adopt in the CVM should not be of paramount concern. Thus, if the respondents are fairly familiar with the payment vehicles, both acceptance and total WTP could be comparable across different payment vehicles. Also, devolution policies do not need to adopt a particular payment vehicle to promote participation.

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