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Anchoring Effect in Context of a Familiar Good: A Case Study of Irrigation Water Supply in Rural India

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Literature shows that the presence of anchoring effect invalidates contingent valuation results. However, studies from developing countries have not addressed this phenomenon adequately. In this paper, indication of anchoring effect was tested using results from a contingent valuation exercise for a familiar good – canal irrigation water used by farmers – in a rural region of India. A single bound dichotomous choice question was followed up by a final open-ended question about the respondents' maximum willingness to pay for improved water supply. Anchoring effect was not detected which is consistent with the argument that familiarity reduces anchoring. Furthermore, validity tested through a scope insensitivity test shows that the estimated economic values are valid.

Keywords: Irrigation Water, Contingent Valuation, Anchoring Effect, Construct Validity, Developing Country

JEL Classification: Q25, Q51

I. INTRODUCTION

The psychological phenomenon of *anchoring* occurs when individuals use some random number as an anchor to judge the outcome of an uncertain event. Although random, these anchors can lead to systematic errors in the outcome. In a demonstration of anchoring, Tversky and Kahneman (1974) conducted

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experiments which involved asking the subjects whether the percentage of African nations in United Nations was higher or lower than a random number generated by the spin of a wheel of fortune. They were then asked to disclose their exact estimate of the event in percentages. This experiment was repeated with multiple groups of people, each with a different random number. They found that on an average, the values from each group centred on the corresponding random number. In contingent valuation studies (CV) anchoring effect has been tested for different closed-ended formats such as the dichotomous choice (DC) format, where the respondents consider the offered bid amounts to be an indication of the value of the good described in the CV scenario.

In developing countries many studies continue to follow-up a closed ended DC type question with a final open-ended question (Whittington *et al.* 1990; Raje *et al.* 2002, Weldesilassie *et al.* 2009). Such a "within-sample" survey is a much more cost effective method of collecting preferences of respondents as compared to spilt-sample surveys. This is especially true in developing countries where in-person interviews[1] are the most appropriate but an expensive mode of conducting stated preference surveys. However, there is inadequate discussion of the anchoring effect (see Gelo and Koch 2012) which may occur in the open ended (OE) follow-up question. If the OE values are anchored on the preceding DC bids, the estimated willingness to pay (WTP) will be a function of the initial bids rather than internal preferences (see Boyle *et al.* 1997). This phenomenon is not restricted to goods that are unfamiliar to the respondents but also extends to familiar goods. Northcraft and Neale (1987) conducted an experiment to test if anchoring was present in valuing a piece of real estate property and they interviewed college students (for whom it was an unfamiliar good) and professional real estate agents (for whom it was a familiar good) for the study. Their results show that both groups exhibited anchoring tendencies, implying that this phenomenon is not restricted unfamiliar goods but also extends to familiar goods. However, familiarity has been found to reduce the bias (Silverman and Klock 1989, Bateman *et al.*2006, Alevy *et al.*2011).

[1]As compared to telephonic or mail interviews, in developing countries, in-person interviews provide researchers a better opportunity to engage with the respondents directly and eliminate their suspicions and doubts about the survey. It is a much more suitable method of interacting with the respondents when literacy levels are low, language and cultural differences are many, addresses are not maintained systematically and large portions of the population do not own telephone lines or are simply unwilling to participate in a mail or telephonic survey (Alberini and Cooper 2000).

Results of a study conducted on the economic value of improved irrigation water supply, which is a familiar good, among farmers in the command area of the Malaprabha Dam Project in northern Karnataka are presented. Presence of anchoring effect is tested in a "with-in sample" survey using a t-test and the results indicate that there is an absence of anchoring effect. This is consistent with the findings of Silverman and Klock (1989) that respondents' familiarity with the good reduces anchoring effect. The validity of the CV results was further examined by testing for construct validity, where the null hypothesis of scope insensitivity to different quantities of irrigation water was rejected at 5% level of significance.

II. CV DESIGN AND SURVEY

Primary data were collected through in-person interviews with 227 farmer households from four villages in *Bagalkot* district of northern Karnataka between June 2007 and September 2007. The sample households were located in the tail-end of the Malaprabha Dam Project. In a year, water from the Dam is typically released from the first week of August up till the first week of February. This period covers the entire wet season and a part of the dry season. Although the farmers faced varying degrees of water scarcity, it became evident during the pilot survey that in general they considered the prevailing supply of irrigation water through canal to be insufficient in meeting their irrigation requirements in a normal year (Biswas and Venkatachalam 2015).

The final field survey was conducted after extensive focus group discussions with the farmers and two rounds of pre-testing of the survey instrument. The good to be valued was *30 additional irrigation rounds* which would be provided to the farmers between August and February of each year for a five year period starting from 2008. It translates into four to five additional irrigations for each farmer in a month. In the CV scenario, the DC format provided the households with the "initial charge" and the follow-up OE format was used to arrive at the "final bid." The bid vector was designed to capture the heterogeneity in preferences of the sample households and was based on the OE responses gathered during the pre-tests. The final bid vector had four bids (INR 90, INR 190, INR 340 and INR 540) which were randomly assigned to the households. The lowest bid was selected in such a manner that it would fetch close to a 100% *yes* responses and the highest bid would induce close to a 100% *no* responses (Haab and McConnell 2002). Each farmer was asked if his/her household would be willing to pay INR X/acre/year in additional water charges to the concerned State level water authority – *Karnataka Neeravari Nigama Limited* (KNNL).

Each of the bids was then followed up by an open-ended question –"what is the maximum you will be willing to pay for the 30 additional irrigations?" For example, a respondent was asked "are you willing to pay INR 340 for having 30 additional rounds of irrigation in a year?," after collecting the response (*yes* or *no*) the respondent was then asked "so what is the maximum you are willing to pay for the above improvement?" and these open ended responses were also collected. For minimising possible strategic responses, the respondents were told that they are only one among many farmer households being interviewed in the study area and therefore, a single respondent could not influence the policy outcome through her/his response. In addition, they were told that the programme would be implemented only if all the beneficiaries of the programme were willing to pay for the improvement. They were also informed that the revenue generated from the additional water charge would be used towards maintenance of the canal and distributaries and a poor revenue collection will cause poor service delivery. They were also reminded of their budget constraints and substitutes (buying water from neighbor or using groundwater). Additionally, a range of follow-up questions were asked to the respondents at the end of the CV section to identify biased responses.[2]

During the preliminary analysis, those households which did not want to participate in the programme at all (05) and those who provided biased responses (17) were identified and dropped from the original 227 observations and all further analysis was carried out on the remaining 205 observations.

III. RESULTS FOR ANCHORING EFFECT AND CONSTRUCT VALIDITY

The central objective of this paper is to examine whether the value generated from the OE series is anchored on the corresponding DC bids or not. A descriptive analysis shows the distance between the mean WTP from the OE format for each corresponding DC bid (Table I).

[2]The farmers were asked to state their motivations for accepting or rejecting a bid through follow-up questions. These responses were then classified as: (a) "this is my value;" (b) "budget;" (c) "water is important to me;" (d) "government should provide it for free;" (e) "I will get the water anyway;" and (f) "I want to make sure water reaches my fields." Following Jorgensen and Syme (2000), responses coded as (a),(b) and (c) were considered as valid responses, whereas (d), (e) and (f) were considered as "biased responses" (see Biswas 2011).

TABLE I

DC BIDS AND CORRESPONDING MEAN WTP VALUES

DC bid (In INR)	Sample *N*	Mean WTP from OE	95% CI (lower bound – upper bound)	Median WTP from OE	Std. Dev
90.00	55	114.00	(95.97 – 132.05)	100.00	66.70
190.00	45	195.00	(148.32 – 241.68)	190.00	155.35
340.00	52	302.00	(258.83 – 344.44)	350.00	153.73
540.00	53	283.00	(230.82 – 335.41)	250.00	189.72

Source: Primary Data.
Note: N=205 after removing biased responses from the original dataset of 227 observations.

Though the mean WTP values differ in absolute terms, this does not tell us about the "statistical significance" of the distance. Hence, a *t-test* is performed to test the null hypothesis that the mean WTP value from OE is not significantly different from the corresponding DC bid. The null hypothesis for the bids is as follows:

$$H_0\colon\ Mean\ WTP{-}OE_{(q)} = DC_{(q)}$$

$$Where\ (q) =\ Rs.(90, 190, 340, 540)$$

Each of the DC bids and their corresponding OE series were subjected to *t-test* of significance. Results of the *t-test* reported in Table II shows that for the lowest bid of INR 90 the null hypothesis is rejected at 10% level. Similarly, at DC bids of Rs. 340 and Rs. 540 the null hypothesis is rejected at 5% and 10% levels of significance. This indicates that the respondents did not anchor their OE WTP values on the previous DC bids, thus adhering to rational choice theory. However, in the case of DC bid INR190, the *t-test* shows that the null hypothesis cannot be rejected even at 10% level of significance. It implies that the mean OE-WTP and the corresponding DC bid are statistically similar and in effect respondents seem to have anchored their OE values with the DC bid of INR 190. As the bids were randomly assigned to all the respondents, these particular set of respondents do not have any reason to behave in any special way. However, it is possible that the mean WTP for the 30 additional improvements is close to INR 190. In the present paper, the second explanation seems to hold true (see results in Biswas and Venkatachalam 2015). In the case of genuine anchoring, similar outcome would have occurred in the remaining bids as well.

TABLE II

HYPOTHESIS TEST FOR ANCHORING BIAS

Null Hypothesis	t-stat	Degrees of Freedom
$H_0: Mean_{OE} = DC_{90}$	2.668* (8.994)	54
$H_0: Mean_{OE} = DC_{190}$	0.261 (23.162)	45
$H_0: Mean_{OE} = DC_{340}$	-1.800* (21.319)	52
$H_0: Mean_{OE} = DC_{540}$	-9.857** (26.060)	53
$H_0: Mean_{OE} = DC_{290}$	-5.791** (11.55)	204

Note:* significant at 5% level of significance; **significant at 10% level of significance. Std. errors are in parentheses.

The construct validity of the CV results is further tested by performing a test for "scope insensitivity." Economic theory tells us that for a good with positive utility – such as irrigation water in water scarce locations – more of the good is preferred to less of it as long as declining marginal utility does not set in (see Carson 2012). Scope insensitivity occurs when respondents are unable to correctly judge how much additional utility they will receive as the size of the good increases. Several studies have, however, reported that respondents expressed very similar WTP values for different scopes of the same good which have passive use values (Veisten *et al.*2004: 317), and this can raise questions about the validity of the CV results (Boyle *et al.*1994). However, there is also a case for testing for scope insensitivity in context of an active-use non-marketed good with which respondents have familiarity. Therefore, it was tested to see if the farmers were indeed able to differentiate between the utility received from varying scope or levels of water supply improvements. For this purpose, the farmers were also asked "how much would you be willing to pay for 10 additional irrigations?" The test was designed to compare the mean WTP for 30 additional irrigations against the mean WTP for 10 additional irrigations. Since income has been found to be one of the most significant factors, which affect the WTP for irrigation water (Tang *et al.*2013, Weldesilassie *et al.*2009), scope affect was also tested across poor and non-poor households. Presently, the Indian government classifies INR 27 per capita per day as the poverty line for rural households; therefore, households which earned an annual income of less than INR 9,855 were considered poor households, whereas all other households were considered as non-poor households. Additionally, scope effect was tested across

high water scarce and low water scarce regions. Therefore, those households which received water from near the middle-reach of the canal were considered as low water scarce regions and were classified as zone B, whereas villages that received water from tail-end regions were considered as high water scarce regions and were classified as zone A.

For the 205 households, the estimated mean WTP value for the "30 additional irrigation" scenario was INR 223/acre/year and for the "10 additional irrigation" scenario it was INR 84/acre/year. Both the mean values were estimated from their respective OE series. A *t*-test for equality of means was rejected even at 1% level of significance for all income categories tested (Table III).

TABLE III

HYPOTHESIS TEST FOR SCOPE EFFECT

	Mean difference	Std. deviation	Total sample (N,n)
Null hypothesis: Mean WTP $_{30}$ – Mean WTP $_{10}$ = 0			
Total sample	-138.68 (-27.42*)	70.90	205
Average annual income (In INR)			
Less than 9,855	-152.88 (-18.41*)	54.44	43
9,855 – 20,000	-134.59 (-10.41*)	60.39	22
20,000-50,000	-142.29 (-17.00*)	68.15	66
More than 50,000	-127.86 (-13.02*)	83.28	74
Zones (A&B)			
High water scarce region (zone A)	-117.67 (-17.55*)	69.37	107
Low water scarce region (zone B)	-161.46 (-21.26)	65.87	98

Note: Figures in parentheses are the t-value.
* denotes significance at 1% level.
USD 1 = INR 43 at 2008 exchange rates.

The above results also show that farmers from both the zones were highly sensitive to the amount of additional water they would receive; Their mean WTP was significantly lower when they were offered only 10 additional irrigations as compared to when they were offered 30 additional irrigations. However, the mean WTP for the 10 additional irrigations for farmers from zone A (INR 105/acre/year) was nearly twice the WTP of farmers from zone B (INR 61/acre/year); this follows standard demand theory which states that as scarcity increases (reduced supply of canal water), the price of the good increases (expressed as WTP). This finding corresponds to the sentiments expressed by the farmers during the field research that 10 additional irrigations would yield meager additional benefits in terms of added yield and therefore, their WTP reflects the internalisation of this expected net benefit (Biswas 2011). Overall, the results of scope insensitivity test show that the farmers, irrespective of their economic status and degree of water scarcity, preferred to use larger quantities of irrigation water to lesser quantities of it and were willing to pay substantially higher for larger volumes of water supply.

IV. CONCLUSION

The results of the anchoring test indicate that for a familiar good, respondents from a rural region in developing country did not use anchoring to arrive at their values. Farmers in rural India, having rich knowledge of different aspects of agriculture and irrigation, were able to form their preferences clearly and did not anchor their values on the cues (in the form of bids) provided in the CV scenario. This conclusion is consistent with Silverman and Klock (1989), Bateman *et al.* (2006) and Alevy *et al.*(2011). However, this outcome might change for different goods and different institutional set-ups and it is recommend that such tests for anchoring became a natural part of CV studies in developing countries. The test for scope insensitivity as an additional test of validity of the CV results found that the null hypothesis of scope insensitivity was rejected even at 1% level of significance. It can be concluded that a well designed scientific CV instrument is capable of eliciting true economic values in rural regions of developing countries. The true economic values generated from such exercises can be used in creating policy designs for appropriate inter- and intra-sectoral allocation of irrigation water and also for designing appropriate irrigation pricing structures.

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