A Note on the Existence of Starting Point Bias in Iterative Bidding Games

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This note further illuminates the strength and direction of starting point bias in iterative bidding procedures. Conflicting recent findings concerning the starting point bias phenomenon are first briefly overviewed. The hypothesis that starting values influence valuations obtained in iterative bidding games is then tested in an experimental setting using widely disparate starting values ranging from $1 to $8,000. Statistically significant differences in mean final bidding outcomes were consistently detected in games using different starting values. This evidence, combined with test results reported elsewhere, strongly suggests that starting point value selection can have subtle but significant effects on observed final bids.

The purpose of this note is to further illuminate the strength and direction of starting point bias in iterative bidding procedures. To date, most experiments concerning starting point bias in iterative bidding games have focused on comparing responses using relatively similar starting values ($1 versus $10, $25 versus $125, or $1 versus $50). This study has pursued the matter one step further by using widely disparate starting values ($1 versus $800, and $1 versus $8,000). This approach allows biases to be detected which may be otherwise overwhelmed by other influential survey design factors such as choice of payment vehicle or sample selection. Statistically significant differences in mean final bidding outcomes were detected in games using different starting values. This evidence, combined with test results already reported by other authors, strongly suggests that values selected to initiate bidding games can have an appreciable impact on observed final bids.

Research on iterative bidding games has examined various sources and direction of biases associated with the method. Particular attention has been devoted to measuring whether inherent structural characteristics of bidding procedures, including selection of starting bid values, significantly influence bidding outcomes. Rowe *et al.* hypothesized that selection of starting value may affect iterative bidding game results through a combination of two effects: (1) if the starting value is far away from the true bid value, the iterative bidding process may fatigue or exasperate the respondent, thereby providing incentive to terminate the game before the true final bid amount is reached, and (2) the starting value conveys information to respondents about expected or reasonable bids and thereby influences the final bid outcome.[1] These two sources of bids can

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[1] Brookshire *et al.* (1974) were perhaps the first to explicitly recognize the starting point bias phenom-

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be called the exasperation effect and the information transfer effect.

Rowe *et al.* tested the effects of using three bidding starting values ($1, $5, $10) in willingness-to-pay (WTP) and willingness-to-accept-compensation (WTAC) question formats. The impact of starting bids on final bidding outcomes was tested by estimating two separate bid curves to explain variation in observed WTP and WTAC final reported bids. In both the WTAC and WTP regressions, estimated coefficients associated with starting value variables were positive, indicating a direct relationship between final bids and starting bids. However, only the starting value term appearing in the WTP bid equation was statistically significant at the 0.10 level.

Thayer experimented with $1 and $10 starting values using WTP question formats. Mean final bids for alternative starting values were compared using one-way analysis of variance. Although they were not shown to be significantly different, mean final bids were found to be inversely related to starting values used to initiate the bidding process.

Brookshire *et al.* (1981) tested for starting point bias in bidding games used to measure willingness to pay for air quality improvements. Three starting values ($1, $10, $50) were experimented with. Mean final bids obtained for 12 residential areas were compared. A total of 36 pairwise t-tests of differences between means were conducted. In 30 of the tests (83 percent), the hypotheses that the mean bids were the same could not be rejected at the 0.10 level.

More recently, Desvousges *et al.* reported detecting starting point bias in a study of option prices and user benefits associated with discrete water quality changes. Two starting values ($25, $125) were experimented with in WTP bidding game question formats. Research findings indicated that mean user benefits were 4.6 to 5.5 times higher when starting values of $125 rather than $25 were used to initiate the bidding procedure. A positive relationship between mean final bidding outcomes and starting values was consistently observed. However, statistical testing to detect differences between mean bidding outcomes yielded inconclusive results.

Further Empirical Evidence

Further testing of starting point bias was conducted in the context of an experimental study of marine recreational fishing valuation in Hawaii.[2] A sample of 100 offshore sport fishermen was randomly selected to participate in personal interviews conducted by professional market research interviewers. This group was further randomly assigned into two subsamples, each comprising 50 anglers. Anglers comprising Subsample I were queried about their willingness to pay a daily fuel tax and their willingness to accept compensation not to fish for a day.[3] An iterative bidding procedure was used to elicit

enon. The bidding procedure they employed involved raising bids of $1 rather than by the more traditional 25 cent increments. This was done to help ameliorate the exasperation effect by more rapidly reaching the final bid amount. No explicit tests of starting point bias were reported by the authors.

[2] A complete description of survey procedures and results can be found in SMS Research.

[3] The exact wording of the questions is as follows:

"Suppose that you were going to fill up your boat's fuel tank to go out fishing the next day. You hear that a new tax has been placed on fuel used for sportfishing. Would you go ahead and buy the fuel so that you could go fishing if the tax increased the cost of fishing trip by $_____?"

"Finally, imagine that the day before you are planning to go offshore sportfishing, you find out that all sportfishing trips for the next day will have to be cancelled because of top secret Navy operations. However, you will get a cash reward to make up for the trouble caused you. Would you be satisfied with a cash reward of $_____ if you could not go offshore sportfishing as planned?"

these values. The questionnaire instrument was designed such that the sequencing of the two bidding games was unchanged for all respondents. First the WTP bidding game was played followed by the WTAC game. Although this procedure simplified the interview process, it could have possibly introduced a source of bias in anglers' responses to the WTAC question. The extent of this bias would depend on whether knowledge obtained in the initial WTP bidding game was used by anglers to modify their bidding strategies in the subsequent WTAC game. However, due to significant differences in WTP and WTAC question formats, combined with the lack of opportunity for anglers to learn how to influence the bidding process, it was anticipated this strategic role playing behavior would be inconsequential in terms of influencing final bidding outcomes.

For half of Subsample I, the bidding procedure for both the WTP and WTAC question formats began at a starting value of $1. The remaining 25 anglers in Subsample I began the bidding procedure at a starting value of $800. Selection of these starting values was guided by two interrelated concerns. First, there was the desire to select values such that their range accommodated all anglers' true valuations. Selection of sufficiently wide value ranges would presumably eliminate the problem of having to curtail bidding games prematurely due to structural constraints on available bidding options. Unfortunately, no prior studies of Hawaii offshore recreational fishing have been conducted to date that might serve to indicate the range of anglers' valuations which might expectedly be encountered. For this reason, estimates of angler consumer surpluses reported for other localities were used as guides. The need to select a wide enough initial value range was conditioned by a second concern to select starting bids that were realistic to respondents. Based on comments made by other bidding game experimenters, it was anticipated that excessively low and high initial bid values could adversely affect the perceived credibility of the hypothetical valuation scenarios being used. As a consequence, anglers might not accurately reveal their true valuations during the bidding game process.

No attempt was made to formulate a formal testable hypothesis concerning the perceived realism of starting values used here. This leaves open the question of whether the bidding results were significantly influenced by use of widely disparate initial bid amounts. As suggested below, there is evidence that starting values did at least have an effect on anglers' willingness to respond with positive final bids.

Due to interview time constraints, and the desire to minimize the exasperation effect, a maximum of five bidding iterations were allowed for each question. A strict bidding scheme that accommodated the iteration constraint was developed and adhered to (see Figure 1). The bidding process could be described as oscillatory because it converged on a final bid from both directions. As such the procedure differed from earlier bidding games where unidirectional increments (or decrements) in bids were used. While it is possible that large swings in bids may have confused or annoyed respondents, this was not tested for. A clear advantage of the scheme, however, was that apart from differences in the starting bid, the bidding sequence was exactly the same for $1 and $800 bids. Consequently, the "information transfer effect" could be related directly to the initial bid amount, rather than to the overall bidding process.

Within this bidding structure, final reported bids were generally constrained to lie between $775 and $25. Exceptions to this occurred when the bidding process ended prematurely at the first bidding iteration. For example, if in a WTP question a respondent stated "yes" to a starting value of $800, then $800 was recorded as

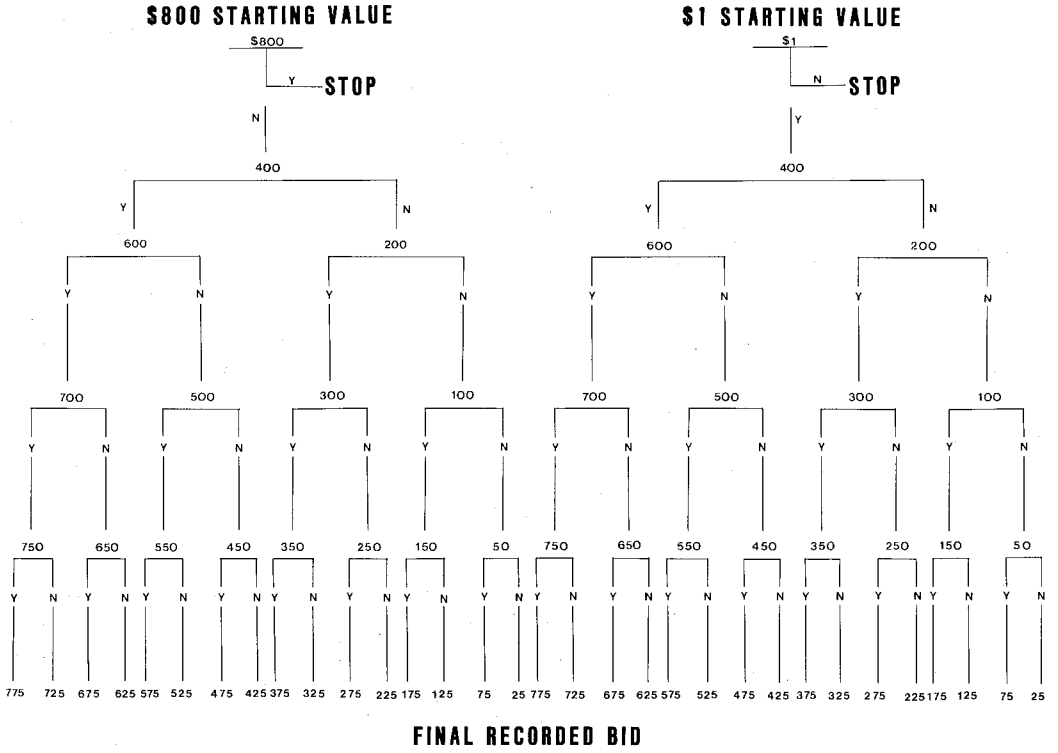

Figure 1. Bidding Scheme Followed for the "Willingness-to-Pay" Question Format Using $1 and $800 Starting Bid Values.[a]

their final bid. Similarly, if an angler stated "no" to a starting value of $1, then $1 was recorded as the final bid. However, before the bid was recorded, a determination was made through subsequent questioning whether the respondent was actually refusing to play the game. In WTAC question formats, the opposite held true. Final bids of $800 were recorded when a respondent stated "no" to a starting bid of $800, and final bids of $1 were recorded when anglers expressed a willingness to accept a starting bid of $1.

Anglers comprising Subsample II were queried about their willingness to pay an annual user fee, and their willingness to accept compensation not to fish for a season.[4] An iterative bidding procedure was employed and again the sequencing of questions was kept uniform for all anglers in the subsample. The starting values used were $1 and $8,000. Both values were selected to accommodate the concerns discussed above. A higher initial bid ($8,000 versus $800) was used because a fishing season was being valued rather than an individual fishing trip. The bidding procedure was limited to five iterations, and followed the plan given in Figure 1 with the exception that all bids (other than $1) were an order of magnitude greater.

[4] The exact wording of the questions is as follows:

"Suppose that the Federal Government just passed a law that required all boat users to pay an annual user fee. Would you go ahead and pay the annual tax so that you could go offshore fishing in 1983 if the amount which you had to pay was set at $_____?"

"Finally, suppose that the government asked you to stop fishing for the rest of 1983. In return, you will receive a cash award. Would you go along and not go offshore fishing in 1983 if the cash award was $_____?"

TABLE 1. Number of Respondents Refusing to Answer or Reporting $0 Bids for Alternative Question Formats.

Subsample	Question Format	Refusals	$0 Bids	Refusals	$0 Bids
		Starting Bid = $1		Starting Bid = $800	
I	Willingness to Pay Daily Fuel Tax N = 25	2	2	10	1
I	Willingness to Accept Payment Not to Fish for Day N = 25	5	2	6	1
		Starting Bid = $1		Starting Bid = $8,000	
II	Willingness to Pay Annual User Fee N = 25	5	0	18	2
II	Willingness to Accept Payment Not to Fish for a Year N = 25	8	0	8	0

During the actual fielding of the various bidding games, many anglers expressed reluctance to engage in the bidding activity. To a lesser extent, other anglers stated emphatically that they would pay or receive nothing ($0). It was subsequently determined through questioning whether such bids were legitimate $0 bids, or protest bids. Protest bids were treated as nonresponses. Anglers who responded with legitimate $0 bids were assigned a final bid value of $0. Anglers who refused to answer a given question were not considered legitimate observations for that particular question. The number of anglers in both of these categories differed depending on the specific question format and starting value used (Table 1). High starting values used in WTP question formats appear to have discouraged or alienated the most respondents as evidenced by the relatively high refusal rates for these questions. This finding is important because it indicates that selection of starting

TABLE 2. Final Bid Outcomes for Different Starting Values: All Respondents Except Refusals.

Subsample	Question Format	Mean Bid[a] (X1)	Standard Deviation (S1)	Mean Bid (X2)	Standard Deviation (S2)	Calculated T-Value[b] Ho: X1 = X2
		Starting Bid = $1		Starting Bid = $800		
I	Willingness to Pay Daily Fuel Tax	$9 (23)	$19	$90 (15)	$198	1.96*
I	Willingness to Accept Payment Not to Fish for Day	$189 (20)	$204	$667 (19)	$297	5.88**
		Starting Bid = $1		Starting Bid = $8,000		
II	Willingness to Pay Annual User Fee	$42 (20)	$179	$1,428 (7)	$2,918	2.19**
II	Willingness to Accept Payment Not to Fish for a Year	$5,176 (17)	$2,521	$6,902 (17)	$2,607	1.96*

[a] Number of observations used to calculate means given in parentheses.

[b] $T = [(X1 - X2)/\sqrt{(N1 - 1)(S1^2) + (N2 - 1)(S2^2)}]\sqrt{[(N1*N2)(N1 + N2 - 2)]/(N1 + N2)}$.

* Indicates significant at the 0.10 level.

** Indicates significant at the 0.05 level.

bids may do more than just influence final observed bids. It may also lead to outright rejection of the hypothetical market scenario by respondents. Another factor influencing refusal rates was question format. Questions aimed at determining annual WTP and WTAC consistently drew more refusals to answer than questions concerned with marginal (daily) WTP or WTAC. Perhaps this is due to the fact that respondents perceived it less risky to incorrectly value a day of fishing compared to incorrectly valuing an entire year of fishing. If so, respondents would tend to be relatively less interested in playing the annual WTP or WTAC bidding games. Furthermore, the perceived realism of valuing a year of fishing is probably less than trying to value a fishing day.

Statistical results of four bidding game outcomes are given in Table 2. Mean final bids were observed to be considerably higher for WTAC question formats when compared to WTP responses. This is consistent with findings reported elsewhere by Rowe *et al.*, Bishop and Heberlein, and others. As might be expected, mean bids observed for both WTP and WTAC questions were lower for Subsample I (daily use values) than for Subsample II (annual use values).

To measure the effect of starting bid values on final bidding outcomes, four pairwise t-tests were conducted to detect statistically significant differences between mean final bids for alternative starting values. Test results are given in Table 2. For all four question formats, the hypothesis was rejected at the 90% confidence level that the mean final bids were the same regardless of starting bid value. Significantly higher mean bids were consistently observed for higher initial bid values. Relative differences in mean bid outcomes were most perceptible in the WTP question formats. For these question formats, mean final bids were 10 to 34 times greater for the higher starting bids. On the other hand, mean final bids observed for the WTAC questions differed by a factor of 1.3 to 3.5.

The statistical relationship between observed final bids and starting bid values was also examined by estimating bid curves for alternative question formats. Four separate bid curves were estimated using ordinary least squares regression (Table 3). Inclusion of explanatory variables such as family income, age and fishing frequency permitted a determination to be made of the impact of starting bid selection on final bids, holding other potentially relevant factors constant. Regression results consistently showed positive coefficients for the starting bid variables. In all equations except the estimated bid curve for a daily fuel tax, the starting bid variable was significant at the 0.05 level.

While analysis of variance results suggests that a significant positive link exists between starting bids and final bidding outcomes, the underlying cause of the phenomenon is not yet evident. Further data analysis was conducted to investigate the information transfer effect, and how it may bias observed bids. Both Thayer and Rowe *et al.* have argued that initial bids may influence respondents' perception of legitimate final bids. An extreme of this situation is where respondents accept the starting bid as their final bid. The probability seems low that a randomly selected respondent would have a true valuation exactly equal to the starting bid. Therefore, when a respondent's stated bid equals the starting bid, it would seem that either the respondent is excessively cooperative, or the information transfer effect is profoundly strong.

For all question formats, a count was made of the bids for which the final bid equaled the starting bid. These bids were then removed and the mean bids reestimated for all question formats and starting values. The results showed that out of a total of 200 bidding games played, 76 games (38%) resulted in final bids equalling starting bids (Table 4). This outcome

TABLE 3. Estimated Bid Curves for Alternative Question Formats.

Dependent Variable	n	Independent Variables[a]					R²	F[b]
		Intercept	Family Income	Age	Fishing Frequency	Starting Bid		
Willingness to Pay Daily Fuel Tax	31	−325.8 (−2.09)**	32.17 (1.42)	7.99 (0.29)	1.80 (2.80)**	75.79 (1.59)	0.31	3.02 (0.036)
Willingness to Accept Payment Not to Fish for Day	32	−106.6 (−0.33)	−13.76 (−0.36)	−35.31 (−0.73)	0.527 (0.48)	481.6 (5.43)**	0.59	9.54 (0.0001)
Willingness to Pay Annual User Fee	25	−114.1 (−0.36)	7.55 (0.17)	−37.52 (−0.67)		2.69 (2.44)**	0.24	2.24 (0.103)
Willingness to Accept Payment Not to Fish for a Year	29	−2,523 (0.94)	−125.7 (−0.28)	1,569 (2.52)**		2,087 (2.55)**	0.38	5.28 (0.006)

[a] Numbers in parentheses below each coefficient are calculated t-statistics. ** indicates significant at the 0.05 level of significance.
[b] Numbers in parentheses represent significance levels.

was observed most frequently in games using \$1 starting values. Choice of question format also appeared to be a relevant factor. In WTP questions, 95% of the cases where final bid equalled initial bid, the starting bid was \$1. Conversely, in WTAC questions, 74% of the cases involved either \$800 or \$8,000 starting bids. Overall, however, the phenomenon was observed with nearly the same frequency in WTP and WTAC question formats. It was found that only 6 respondents out of the sample of 100 reported final bids equal to starting bids for both bidding games they played. These respondents were therefore responsible for 12 (16%) of the 76 instances where the phenomenon was observed. This suggests that the phenomenon is not simply a sampling peculiarity.

Recalculated mean bids were less divergent for alternative starting values. Furthermore, in all but one question format, revised mean bids for larger starting values were less than revised mean bids for \$1 starting values. A positive relationship between starting bid and final mean bids was therefore not evident. Again, four pairwise t-tests were conducted to detect statistically significant differences between revised mean final bids for alternative starting value. Only the revised mean bids for the annual WTAC question could be shown to be significantly different from each other at the 0.10 level of significance.

Discussion and Conclusion

Selection of starting values in iterative bidding games appears to influence final mean bids in a variety of ways. Starting values seem to alter the perceived realism of the hypothetical market being created, and thereby influence refusal rates. There also appears to be a link between starting values, question format and respondents' acceptance of starting bids as final bids. However, even after these factors are accounted for, starting value selection can

TABLE 4. Final Bid Outcomes for Different Starting Values: Effect of Excluding Observations Where Starting Bid Equals Final Bid.

Question Format	Starting Bid	Number of Excluded Observations	Revised Mean Bid[a]
Willingness to Pay Daily Fuel Tax	$1	16	$29 (7)
	$800	1	$39 (14)
Willingness to Accept Payment Not to Fish For Day	$1	8	$315 (12)
	$800	15	$169 (4)
Willingness to Pay Annual User Fee	$1	19	$800 (1)
	$8,000	1	$333 (6)
Willingness to Accept Payment Not to Fish For Year	$1	2	$5,867 (15)
	$8,000	14	$1,783 (3)

[a] Number of observations used to calculate revised means given in parentheses.

still alter observed mean final bids in a statistically significant manner.

All these effects were observed in this study which incorporated a streamlined bidding procedure to minimize potential exasperation effects. This finding suggests that the information transfer effect of selecting a certain bidding starting point may be more important than the exasperation effect in influencing final bid outcomes.

The relationship between starting bid and refusal rate is an especially complex issue that remains unresolved. Looking at Table 1, it is clear that relatively high refusal rates were associated with WTP questions when large initial starting values were used. If individuals who refused to play the bidding game were also those with low actual valuations of the recreation experience, then the number of refusals would be inversely related to estimated final mean bid outcomes. Given that this appears to be the case here, it can be hypothesized that high starting values might have somehow served as a behavioral cue to respondents that influenced their willingness to participate in the game. This is an acute empirical concern when choice of a starting value screens out a certain class of respondents whose valuations are therefore unrepresented in final mean bid calculations. Conceivably, low starting bids may screen out high-value users. High initial bids may discourage low-value respondents. While this phenomenon is not tied directly to the information transfer effect, it may nevertheless lead to biased value estimates.

Taken together, the results presented here suggest that the information transfer effect works in subtle, yet influential ways. The effect can perhaps be ameliorated by obtaining a reasonably accurate estimate of the final mean bid amount before conducting final field interviews using iterative bidding games. A simple pretesting procedure using an open-ended question format could probably suffice to identify confidence intervals that encompass most users' true valuations. The closer the initial bid is to the final bid outcomes, the less likely that starting point values will bias final estimated values because of respondents' refusal to participate. Pretesting does not, however, overcome the problem of overly cooperative respondents who accept any initial bid as their final bid. Finally, in view of the seemingly positive relationship between final bids and starting values, use of a range of starting values within a single survey should probably be encouraged. In this way, biases associated with high and low starting points can perhaps be internally compensated for.

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