# Empirical Testing of Strategic Voting and its Implications for Choice Experiments

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## 1. Introduction

Dichotomous contingent valuation and choice experiments are important non-market valuation methods. Dichotomous contingent valuation is incentive-compatible because in dichotomous contingent valuations, respondents are faced with two options and their dominant strategy is to choose their favorite regardless of their expectation of distribution of the other respondents' votes. Choice experiments are, on the other hand, vulnerable to strategic voting (i.e. respondents consider the choices of others when casting their own choice) because in the presence of multiple options, a respondent's dominant strategy is not voting for his favorite if he holds the perceptions that his favorite has no chance of winning. Instead, he would chose his preferred option of the remaining two option to avoid possibly ending up with his least preferred option. Since the welfare estimates are valid only if each respondent chooses their unconditionally most preferred option, strategic voting may render welfare estimates by choice experiments problematic.

Related research works mainly fall into two categories. One category is about theoretical incentive properties of choice experiments. In Gutowski and Georges(1993), they theoretically analyzed strategic voting behavior in three candidates setting with a plurality decision rule and calibrated insincerity indexes for various single-ballot systems to analyze relationships such as equivalence, nesting and symmetry among these systems. Carson and Groves (2007) carefully examined the incentive and informational properties of single discrete choice, double-bounded formats and open-ended survey formats and stated how people might vote strategically in these surveys. As discussed earlier, in multi-candidate voting scenario with the plurality rule, rational participants will finally vote between the two options which have most chances of winning, which is independent of their unconditionally first choice.

The second strand of literature is about using lab experiments to examine the empirical incentive properties of stated preference methods. Collins and Vossler (2009) conducted a laboratory choice experiments using induced value and found that a low portion of choices are inconsistent with induced value preference. In Vossler and Evans's homegrown value experiment (2009), the criterion validity of contingent valuation was examined by comparing the estimated WTP elicited by different referenda. The result was that contingent valuation has criterion validity if survey questions are consequential, by consequential we mean the participants in the survey care about the discussed good and they believe their response to the survey will affect how it will be provided. Harrison and McDaniel (2008) showed that, in an actual survey, participants might give up strategic voting and answer survey questions truthfully while the questions are not incentive compatible, due to computational complexity to figure out the optimal strategy. In an experiment by Straiten et al. (2010), the result showed that voters behave strategically if computations to figure out the dominant strategies are straightforward. Otherwise, bounded rationality leads to insincere but not strategic voting or sincere voting by experiment participants. Other empirical evidence found the estimated welfare is biased or different from estimates elicited by other methods regardless. Burton (2010) observed strategic voting behavior in an induced value choice experiment by financially rewarding those who are successfully acting as if one or two certain attributes are the only factors matter when they are answering the choice experiment questions. They concluded that motivated participants could bias the result to some considerable extent even though choice experiments are usually being "too complicated to be manipulated strategically". McNair et al. (2010) conducted a homegrown value experiment and found that the preference stated in the first of the sequence paired choices is not statistically different preference stated in the binary choice questions, while the following

of the sequence paired choices are biased compared to preference stated in the incentive-compatible binary choice questions.

We designed an experiment to examine strategic voting in settings that mimic choice experiments. In our experiment, participants were faced with three items (and their prices). They were asked to vote under two decision rules. One is the plurality rule in which participants get the item that wins highest votes. It is a commonly used decision rule in choice experiments and it is under the plurality rule that strategic voting occurs. The second rule is pay-and-go rule in which participants get the item he votes for, is for the purpose of eliciting participants' unconditionally most preferred option. We assumed that participants will vote for his unconditionally favorite given he could get whatever he votes for. We (1) calculated the percentage of strategic voting and mismatched voting. A Participant is deemed as a mismatched voter if he voted for different items in two decision rules. A strategic voter by our definition is the participant who voted for his second most preferred option given his perception that his most preferred option will be voted least; (2) ran a logit regression model to decide which factors affect people's vote under the plurality rule, especially, whether the expectation of other participants' votes will affect people's vote; (3) tested whether "prompting" participants to think about the preferences of others affects their strategic voting behaviors by introducing signal treatments and control treatment.

## 2. Theoretical Analysis of Theoretical Voting in Three-Alternative Settings

Taking the preference order $A \succ B \succ C$ (A, B, C as item 1, 2, 3 respectively) as an example, we examine how a strategic voter will vote. The column 3 and column 4 show the predicted vote by a strategic voter given their preference and their belief about other participants' votes are shown as column 1 and column 2.

We expect there would be participants whose votes hold consistent under two decision rules and also participants who vote for different items under each rule. Mismatched voting behavior under two decision rules is termed as insincere voting in some literature. Reasons for insincere voting include strategic voting, bounded rationality (Harrison and McDaniel, 2008) and passive following the poll information (Meffert and Gschwend, 2011). In our experiment, there is not much computational complexity to figure out the optimal strategy once voting perceptions are formed. We did not publicize previous voting results as "poll information" because we want to observe participants' natural responses instead of suggesting them to take previous voting results into consideration when they vote.

With additional information about participants' perceptions about others' votes, we can also tell a participant who is theoretically in the position of strategic voting, while casts a sincere vote. This happens when a participant perceives his favorite option is going to be least voted by majority, and under this perception he still votes for his most preferred option, then he is voting sincerely. The only situation in which we cannot distinguish between a strategic voter and a sincere voter is when his dominant voting strategy under plurality rule coincides with his unconditional most preferred option. Under either rule, the participant will vote for his most preferred, thus we do not know whether he is a strategic voter or a sincere voter. So voting for one's unconditionally preferred item in the plurality vote could still be an optimal strategy for a strategic voter. So mismatched voting is neither a necessary nor a sufficient condition for strategic voting.

## 3. Experiment Design

We did the experiment with 99 participants on the first three weeks in October at Mississippi State University. The experiment contained 8 sessions, with around 10-14

participants in each session. A show-up fee was ensured if participants showed up. An additional endowment fee was given to participants so that they were able to pay for the item with the endowment.

*3.1.Experiment Goods*

It might be ideal for us to experiment on public goods, which are the target for many real life choice experiments. However, due to the difficulty of providing public goods in experiments, we used private goods as alternatives. We chose homegrown value form experiment instead of induced value form experiment. In contrast to induced value experiment, in which the value/utility is designed by researchers and then imposed on participants, the homegrown value experiment imposes nothing to participants. Though we lost control over participants' preference/utility by using the homegrown value form, the homegrown valuation has the merit of getting more direct and realistic implication for choice experiments, because we used real life goods to elicit people's preference instead of inducing values upon participants. It is also essential to the test of whether prompting participants to think about the preferences or votes of others affects their own votes; in an induced value experiment, strategic voting is not possible unless participants are given information on the preference distribution, which may act as a prompt to incorporate this information when making their decision.

The experiment goods are as: MSU medium size cowbell; MSU tervis tumbler; Gift certificate of Barnes and Noble bookstore $12 value within; Gift certificate of Student Union (the campus dining hall) $10 value within; Gift certificate of Hollywood Cinema $11 value within. We come up with the above alternatives of experiment items due to the following considerations. We would like to experiment with goods that are easily obtained so that we could purchase them at any time between the sessions, which were often scheduled on consecutive days. The

experiment goods are better to be commonly used items so that everybody would have a preference towards them. For budget considerations, we focus on goods with price below $25. And we also want our goods be diverse in usage, appearance and type so that chances that participants will be indifferent towards the options are as low as possible. We decide whether the good is disposable or not will not affect the pretest in an undesirable way because the disposability of goods will affect the participants' preference, while not their voting strategies. We include both disposable good such as certificate card and non-disposable good such as cowbell and mug. Finally, we apply goods with MSU stamp on it as convention. In short, we come up with the above goods; they are easily available, commonly used, inexpensive and diverse.

### *3.2. The Voting Questions*

During the experiment, participants were faced with several sets of three private goods to choose from. Each good was available at a specified price. The tagged price was lower than the good's market price. The combination of three goods remained the same across sessions, while prices varied to ensure that voting behavior was not an artifact of the prices used. Which good they took home was decided by how people vote and which decision rule is binding. Each participant voted for the same set of goods twice, one under the plurality rule and the other under the pay-and-go rule. They were asked to vote for three different sets of goods, so they voted for six times in total. The pay-and-go rule is incentive compatible because participants have no incentives to misrepresent their true preference given that they can get what they vote for.

In each voting situation, the projector displayed the available goods with their prices and descriptions. Whether this voting was under the plurality rule or under the pay-and-go rule was

also indicated and emphasized. In our experiment, voting was done in the order of plurality rule coming before pay-and-go rule for each choice set.

After participants made six choices, a six-sided die was thrown to decide which task would finally decide participants' payoff. In this way, all the voting tasks were made consequential in that each task had a chance of one sixth to finally decide participants' payoff. And each task was independent of the other choices, so participants' choice in each task was also independent of his choice under other choice sets. After the die was thrown, the outcome was determined and announced immediately and then every participant got the item he deserved after paying the tagged price out of his endowment. They left the experiment with their items, their show-up payments, and any remainder of their endowments.

During the experiment, communication between participants was discouraged by physical arrangement of voters, so every participant formed his or her own perceptions and votes independently.

*3.3.Perception and Second-Most Preferred Option Question*

Our definition of strategic voting is a voter who cast a vote for his second most preferred option under the plurality rule given his perception that his unconditionally most preferred option will be voted least. In order for us to detect strategic voting, we need to collect information such as participants' perception about other participants' vote, his unconditional most preferred option and his second most preferred option. The unconditional most preferred option could be revealed by his vote under the pay-and-go rule. For the other information, we directly asked participants.

Below is the question we asked participants regarding their perception about other participants' votes. We asked this for each of the three choice sets.

*Which of the following statements best describes your perception of peoples' choices in task 1[1]?*

*(1) I think the votes for all three options will be roughly even.*

*(2) I think I know which option will get the fewest votes, and the other two options will be roughly evenly voted.*

- *Which option do you think will get the fewest votes?*

*(3) I think I know which option will get the most votes, and the other two options will be roughly evenly voted.*

- *Which option do you think will get the most votes?*

*(4) I think I know which option will get the most votes, which will get the second most votes, and which will get the fewest votes.*

- *Which option do you think will get the most votes?*
- *Which option do you think will get the second most votes?*

Below is the question we asked to elicit participants' second most preferred option. We asked this question for each of the three choice sets. The example is taken from task 2[2].

*In Task 2, you were asked to choose one of the three items under the assumption that you would pay for and receive the item you chose (look at the projector screen for a reminder of the items and their prices). Suppose the item you chose were not available and that only the other two items were available. Which of the other two items would you choose?*

*If my first choice were not available, I would choose the* _____.

[1] The decision rule in task 1, 3, 5 is plurality rule. The perception questions were the same in task 1, 3, and 5.

[2] The decision rule in task 2, 4, 6 is pay and go rule.

After these questions, demographic information, additional information and feedback were collected by questionnaires. Perception questions, second-most preferred questions and the questionnaire were done separately so that participants could not jump back to previous questions to make any change, or looking forward to future questions.

### *3.4. Treatment Effects*

Whether voting questions come before or after perception questions potentially matters because if perception questions come before voting questions, they might remind participants to take the perception of others' votes into consideration when they are making a decision. In order to control the effect of order, we split 8 sessions of experiments into 4 sessions of experiments in the order of perception first, voting next and 4 sessions in the order of voting first, perception next. We termed the first 4 sessions "signal treatment"; and the second 4 sessions "control treatment". We are interested whether the percentage of strategic voting and mismatched voting differs under two treatments.

## 4. **Experiment Results**

### *4.1.Percentage of Mismatch Voting and Strategic Voting*

We calculated the percentages of participants for each choice set who cast a mismatched vote, who voted for second most preferred option, who holds the prior1 that his most preferred option will be voted least and who, according to our definition, is a strategic voter. We found that roughly 18.52% participants cast a vote other than his most preferred option. 83.62% of these participants who voted for an item other than his most preferred one actually voted for their second most preferred option. However, only 5.7% of total participants indicated that they held the perception that his most preferred option would be voted least. Finally, only 2.33% of total

participants could be characterized as strategic voters according to our definition. As discussed earlier, we presume that the actual percentage of strategic voters is higher than 2.33% due to reasons that a strategic voter would vote for his unconditionally most preferred option if he truly believes his most preferred option has a fair chance of winning. We could not tell this type of strategic voters from sincere voters as their optimal strategy is to reveal their true preference. Except for the percentages of strategic voting in choice set 3 and choice set 4, all the other percentages are significantly different from 0.

*4.2.A Logit Regression on Participants' Mismatch Voting*

We are interested in what factors affect participants' choice of casting mismatched votes. Our regression model is:

(1) $$Mismatch_i = a_{i0} + a_{i1}prior1 + a_{i2}white + a_{i3}signal + a_{i4}later + \varepsilon_i$$

(2) $$Voteforse_i = \beta_{i0} + \beta_{i1}prior1 + \beta_{i2}white + \beta_{i3}signal + \beta_{i4}later + \varepsilon_i$$

$\alpha s$ and $\beta s$ are parameters to be estimated. The variable descriptions are given in table 3. The regression results based on all choice sets are shown in table 4, the regression results by individual choice set are shown in table 5. The coefficient of prior1 is significantly greater than 0 in the overall regression for both mismatch variable and voteforse variable, indicating that the participant has higher chance of casting mismatched votes and voted for his second most preferred option under the plurality rule if he holds the perception that his most preferred option would be voted least. White variable is significantly greater than 0 in overall regression, showing that white people has greater chance of being engaged in mismatched voting, voting for second most preferred option behavior than people from other races.

However, in regressions by choice set, only the prior1 variable in choice set 2 is significant. The piror1 variable is not significant in regressions for choice set 3 and choice 4. None of the other variables are significant.

### *4.3.Treatment Effects*

We ran a T-test to test the treatment effects. Our hypothesis is that participants' mismatched voting and voting for second most preferred are same under the signal treatment and control treatment. The T-test result is in Table 6. The statistic is not significantly different from 0. We cannot reject the null hypothesis. This is not consistent with our expectation because we expected more mismatched voting and voting for second most preferred would happen in signal treatment than that in control treatment.

## 5. **Conclusions**

We observed mismatched voting, voting for second most preferred option and strategic voting in our experiment, while strategic voting is observed with much lower frequency than the other two voting behaviors due to our strict definition of strategic voting. We also found mismatched voting and voting for second most preferred option are related with the belief that participant's most preferred option will be voted least. Our experiment shows that participants in three-alternative voting settings might not vote for his unconditionally most preferred option. Given that almost all welfare estimates are derived based on the assumption that participants vote to maximize his utility, which is a function of alternative characteristics and individual characteristics, mismatched voting behavior might affect the validity of welfare estimates from choice experiments. Future work could be done on how mismatched voting or strategic voting affect the welfare estimates from choice experiments.

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**Table 1. Strategic Voting with Different Priors**

| preference of order | priors | vote under plurality rule | vote under pay and go rule |
|---|---|---|---|
| ABC | (ABC) | A | A |
| ABC | A(BC) | A | A |
| ABC | B(AC) | A | A |
| ABC | C(AB) | A | A |
| ABC | (BC)A | B | A |
| ABC | (AC)B | A | A |
| ABC | (AB)C | A | A |
| ABC | ABC | A | A |
| ABC | ACB | A | A |
| ABC | BCA | B | A |
| ABC | BAC | A | A |
| ABC | CAB | A | A |
| ABC | CBA | B | A |

Notes: In column 1, ABC refers to the participant's own preference order. In column 2, ABC means that A is perceived by the participant to be voted by most participants, B second and C least. The same logic applies to ACB, BAC, BCA, CAB, and CBA. A(BC) means A is perceived by the participant to be voted by most participants, while B and C runs a tie. (BC)A means A is least voted, while B and C runs a tie. (ABC) means a three way tie.

**Table 2. Voting Results**

| Choice Set | # Of Observations | Mismatch | Vote for Second Most Preferred | Prior1 | Strategic Voting |
|---|---|---|---|---|---|
| 2 | 99 | 0.1818*** | 0.1616*** | 0.0707*** | 0.0404** |
| | | (0.0390) | (0.0372) | (0.0259) | (0.0199) |
| 3 | 99 | 0.1616*** | 0.1717*** | 0.0707*** | 0.0202 |
| | | (0.0372) | (0.0381) | (0.0259) | (0.0142) |
| 4 | 99 | 0.2121*** | 0.1313*** | 0.0303* | 0.0101 |
| | | (0.0413) | (0.0341) | (0.0173) | (0.0101) |

Notes: Standard errors are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels.

**Table 3. Explanation of Variables**

| Variable | Description |
|---|---|
| mismatch | a binary variable, equals 1 if the participant cast mismatched votes under two different decision rules, and he voted for his second most preferred option under the plurality rule, 0 matched votes |
| voteforse | a binary variable, equals 1 if the participant cast mismatched votes under two different decision rules, and he voted for his second most preferred option under the plurality rule. |
| piror1 | a binary variable, equals 1 if the participant held the perception that his most preferred option will be voted least; 0 otherwise. |
| white | a binary variable, equals 1 if the participant is white; 0 otherwise. |
| signal | a binary variable, equals 1 if the participant is under signal treatment; 0 if control treatment |
| later | a binary varialbe, equals 1 if the choice set the participant voted for comes later in the session. |

**Table 4. Logistic Regression Results**

| Dependent variable: | **Mismatch** | **Voteforse** |
|---|---|---|
| Intercept | -1.0991*** | -1.4088*** |
| | (0.2884) | (0.3129) |
| Prior1 | 1.2972** | 1.5992*** |
| | (0.5272) | (0.5360) |
| White | -0.6566* | -0.6263* |
| | (0.3066) | (0.3317) |
| Signal | -0.3436 | -0.4705 |
| | (0.3096) | (0.3375) |
| Later | 0.1082 | 0.3669 |
| | (0.3217) | (0.3408) |
| Likelihood Ratio | 10.6259 | 13.2394 |
| Pr> ChiSq | 0.0311 | 0.0102 |
| N | 297 | 297 |

Notes: Standard errors are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels.

**Table 5. Logistic Regression Results By Set**

| Dependent variable: | Mismatch | | | Vote for Second Preferred | | |
|---|---|---|---|---|---|---|
| | **set 2** | **set 3** | **set 4** | **set 2** | **set 3** | **set 4** |
| Intercept | -1.6709 | -0.6236 | -1.6441 | 0.529 | -0.0616 | -2.0852 |
| | (1.6931) | ( 1.8266) | (1.4568) | (2.3705) | (1.8347) | (1.7527 |
| Prior1 | 2.0915** | 1.2988 | 1.032 | 2.5247** | 1.0502 | 1.7192 |
| | (0.8561) | (0.9856) | (1.3369) | (0.9217) | (0.9651) | (1.3503) |
| White | -0.3165 | -0.7372 | -1.0578 | -0.9962 | -0.9513 | -0.6428 |
| | (0.6155) | (0.6622) | (0.5808) | (0.6849) | (0.6453) | (0.6861) |
| Signal | -0.5238 | -0.4056 | -0.4044 | -0.5141 | -0.171 | -0.7742 |
| | (0.5742) | (0.5949) | (0.5473) | (0.6286) | (0.5699) | (0.6664) |
| Later | 0.3054 | 1.2248 | -0.7999 | 0.6041 | 1.0652 | -0.7439 |
| | (0.5673) | (0.6548) | (0.7195) | (0.6385) | (0.6359) | (0.8482) |
| Likelihood Ratio | 7.3913 | 6.2691 | 9.678 | 12.2099 | 5.3975 | 4.7423 |
| Pr> ChiSq | 0.3893 | 0.5087 | 0.2076 | 0.0939 | 0.6116 | 0.6914 |
| N | 99 | 99 | 99 | 99 | 99 | 99 |

Notes: Standard errors are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels.

**Table 6. Test Between Treatment**

| Null Hypothesis | Mismatch | Vote for Second Preferred |
|---|---|---|
| Same between signal treatment and control treatment | 0.0359<br>(0.0452) | 0.0445<br>( 0.0421) |
| N | 297 | 297 |