The compensation election and minorities

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Introduction

Skepticism of democracy has a long history, going back all the way to Aristotle. Fear of a majority tyrannizing over a minority – otherwise known as "mob rule" – has played a major part in how governments are organized. The division of powers seen in modern democracies is necessary because it is unlikely for any branch of government to represent citizens unanimously.

In more practical terms, governments often pass laws that negatively affect some, while benefitting others. This turns the government provision of public goods, which are supposed to benefit all, into a zero-sum game in which minorities are unlikely to win. Instead of further constitutional rearrangements, perhaps another approach is possible that will benefit both sides in certain types of elections.

The "Compensation Election" is an auction mechanism that allows players to bid instead of vote, was created by Ryan D. Oprea, Vernon L. Smith and Abel M. Winn. Winners of the auction gain the good they desired, and losers are compensated. So long as players bid upon the good they desire, they will obtain either their good or compensation. This shields minorities against any decision which affects them negatively.

Literary Review

The use of auction methods to distribute public goods is hardly new. Ferejohn and Noll (1976) were examining the PBS Station Program Cooperative, an experimental market for the selection of television programming among public television stations, in the 1970s. However, this form of market suffered similar problems as in majority rule. The SPC was effective at creating a stable equilibrium, but it guaranteed that some stations would not get all the programs they wanted.

Around the same time, Clarke (1971) and Groves (1973) used demand revealing processes to examine methods of improving the efficiency of public good prices, and optimizing team incentives, respectively. Both included a compensation mechanism, so that if agents overpay, they receive a reduction determined by their demand schedule. This compensation should prevent any unfair overtaxing, and encourage agents to be honest when they reveal their demand.

However, these demand revealing processes tend to be extremely complicated, relying upon many steps from legal courts to calculations. Varian's (1994) compensation mechanism simplified them, creating a much more useful mechanism. The caveat emptor of Varian's compensation mechanism is that it's designed for solving externalities. Agents in the mechanism already have full information; the question is just how to get them to reveal it accurately. Varian (1995) later postulated that by tatonnement agents would reach equilibrium after a few rounds of play.

Vernon Smith looked to a different source for inspiration when he created his compensation mechanism. Knut Wicksell (1896), a Swedish economist, had proposed that all changes in public spending must require some form of unanimity to be just, calling it the "Principle of Unanimity and Voluntary Consent in Social Choice." Smith (1977) created his auction election mechanism in the hopes of fulfilling the criteria of Wicksell's principle. In Smith's auction election, players could bid for the public goods they want, or request compensation if they believe they are being hurt. The game only proceeds if all players agree.

This brings us to our paper in question. Oprea et al. (2006) combined the idea of a compensation mechanism with that of an auction election, resulting in the compensation election. Oprea et. al used Wicksell's principle to argue that any outcome where losers are compensated for more than how much they valued their preference will command unanimous support. However, this was not a guaranteed outcome as players could bid against their preferences in the hopes of gaining the compensation. Oprea et. al found this occurred less frequently with larger groups and time, leading to players placing very low bids for their preferred goods. Also, Oprea et al. attempted to examine the minority group, as in the group that valued the not so socially preferred good in any given election. They found no evidence that minorities behaved any differently than those in the majority.

Experimental Design and Research Questions

The experimental design of the original game is set as follows:

First, all subjects will be given two public goods (A, B) and they must choose one of these two goods, depends on their preference. There are 36 rounds in this game. Subjects' values for their preferred good, c, is $v_{ij}^{c} \geq 0$, and the value for their less preferred good is $v_{ij}^{-c} = 0$ with $c \in \{A, B\}$. In the experiment, a subject will make his choice base the value for his preferred good and this value is calculated by this equation, the net value= value for good A – value for good B ($v_{ij}^{N} \equiv v_{ij}^{A} - v_{ij}^{B}$), which is distributed $N(\mu_N \equiv \mu_A - \mu_B, \sigma_{N2} \equiv \sigma_{A2} + \sigma_B^2)$. A subject will choose good A if $v_{ij}^{A} > v_{ij}^{B}$ and B if $v_{ij}^{A} < v_{ij}^{B}$

The original game is trying to test these two variables using two treatments: the size of the group, I, and the distribution out of which the net value, v_{ij}^{N} , are drawn. The large group treatments consisted of 18 subjects, and the small treatments have 6 subjects. Each group played 36 rounds of elections. There are three types election: Even, Close, or Landslide. The difference between each type of election is determined by the distributions of v_{ij}^{N}, the value of the mean and the standard deviation ($v_{ij}^{N} \sim N(\mu_t, \sigma_t^2)$), where $t \in \{E, C, L\}$. Subject values were selected so that $\mu_E = 0$, $\mu_C = 11$, $\mu_L = 51$, and $\sigma_E^2 = \sigma_C^2 = \sigma_L^2 = 33{,}373.67$. Each of the three types occurred six times in the first eighteen rounds and six times in the last eighteen rounds and the ordering of the elections was randomized.

Our experiment is based on this election game, using software built by Jeffrey Kirchner and the Chapman University Economic Science Institute. Our game consists of 9 players, maximum of 12. Each player will be given an endowment of 50 cents and players will participate for 20 periods, and three trial periods preceding the main experiment. In each period, players are given two different items: one with Red value and another one with Blue value. These values are distributed in 3 levels: High (50), medium (25) and low (5). Each group is randomly assigned with these values independently. The players will choose between these two items defends on their individual preference on the each item. Each player's task is to submit a bid for Red or for Blue and the bid (cost) is the amount that players are willing to pay to consume that item. At the end of each round, either the Red item or the Blue item will be chosen, based on the majority rule, which means when the total value of Red item is greater than Blue, Red will be chosen. Thus, either everyone will consume the Red item, or everyone will consume the Blue item in a given period.

There are 3 types of actions available to the players: 1) Bid for their given value. 2) Bid against their value. 3) Abstain (not bidding for anything). Each player will choose their action type base on the payoff they get. Whichever action will give the player the highest payoff, players will likely choose that action. The exact breakdown of payoffs is as follows:

i. Bid for their given value

1. Winning the bid, payoff = value – bid (cost)

2. Losing the bid, payoff = bid + compensation (compensation = (total winning value – total losing value)* (player's bid / total losing value)).

ii. Bid against their value

1. Winning the bid, payoff = value + bid + compensation (TW-TL)*(Bid/TL)

2. Losing the bid, payoff = -bid (do not get their value, and lose their bids)

iii. Abstain

1. Prefer value wins, payoff = value – bid (which is 0)

2. Prefer value loses, payoff = 0

Our experimental design consists of two treatments: for treatment A, players are placed randomly into the majority and the minority group in each round for the first 10 rounds. In treatment B, the minority group is formed with fixed number of players. In these 2 treatments, we are trying to test players' bidding behaviors. Theoretically, we anticipate players in the minority group are more likely to bid against their preferred items. Since they are the minority, there is a higher chance for them not to get what they preferred. We hypothesize that in the treatment B, the last 10 rounds, there will be a greater overall amount of counterbidding and off-preference behaviour as players try to take advantage of the "stable" groups.

Research Questions:

i. What changes are there between treatment A and B? How is counter bidding affected by the change?

ii. Do players bid on preference, and are bids positively related to value (repeating the results of Oprea et. al)?

Results

Initial results suggested that players acted nearly at random. Considering that economics majors have a reputation for ruthlessness, it came as a rude shock to see some of the oddball strategies employed by players in our compensation election. Players 2 and 5 favoured abstaining always and in a majority of rounds, respectively. Player 4 matched their bid to their value – perhaps a hedging strategy?

Many of the players employed more ordinary strategies, and mercifully, these players tended to get the highest payoffs. These same players tended to learn the fastest, while the "oddballs" stuck to rigid strategies. However, this creates an issue: how do we know if our treatments have worked or not? The answer is, we can't tell from the aggregate. We have thus tended to examine individual players behaviour wherever possible, despite having a bevy of regressions available to us.

For most of our regressions we used individual bid data, as in we made few adjustments to the bids that players had entered. For analyzing the minorities and majorities, we borrowed Oprea et. al's method of averaging out bids for a particular value, and then regressing them. This method, particularly with the last 10 rounds produced highly informative regressions. However, unlike Oprea et. al we did not count counterbids as negative bids. Instead, we used a separate dummy variable for counterbids. This was to indicate the size of counterbids, and to give us a better idea of how frequently players counterbid.

Table 1. Regression Results from estimating player bids

	Value Coefficient	Counterbid Coefficient	Adjusted R-squared
All Players, All Rounds	0.30	14.73	0.17
All Players, First 10	0.23	16.50	0.12
All Players, Last 10	0.39	9.67	0.26
Majority Only, First 10	0.20	3.17	0.19
Majority Only, Last 10	0.39	-0.48	0.90
Minority Only, First 10	0.16	-1.75	-0.16
Minority Only, Last 10	0.42	9.38	0.73
Player 1	0.61	-0.57	0.73
Player 3	-0.15	31.84	0.30
Player 5	0.12	8.42	0.19
Player 6	0.57	N/A	0.77
Player 7	0.44	-14.32	-0.02
Player 8	0.23	-0.45	0.19
Player 9	0.40	0.75	0.55

Result 1

By and large, the change in treatments was not especially successful. Despite the three rounds of practice, players did not appear to have fully understood the game mechanics well enough to maximize their payoffs in the first few rounds. In all regressions, players act very differently in the first ten rounds than in the last ten, and there is little evidence it has to do with any minority effect. With our aggregate model, using all 180 combined player actions, the fit is very poor, although both coefficients are significant. This was not very informative, so we split the data in two. There is a large jump in the value coefficient and fit, and decrease in counterbid coefficient from the first ten to last ten rounds. We interpret this as players learning that counterbidding carries with it the severe risk of losing money, whereas bidding on preference guarantees some payoff.

Next we analyzed the majority and minority regressions. At first, it may appear that the majority model echoes the aggregate model, while the minority does not, suggesting that the minority is indeed different. However, the difference in the minority group can be explained. The minority group includes three players who do not fit in the middle: players 3, 6 and 9. Player 3 played a highly risky strategy, preferring to counterbid at extremely high bid prices. This strategy did not work out well for player 3, as they received the lowest payoff of any player. Player 6 was the only player (bar 2, who abstained in every round but one) who did not counterbid at all in the last ten rounds. Player 9 received the highest payoff, and did so by counterbidding frequently, but at low values. The combination of these three players explains why the bid coefficient is average (3 and 6 cancel each other out), the counterbid coefficient somewhat low (6 and 9 pulling down 3), and the fit worse than the majority model (all three behaved very differently).

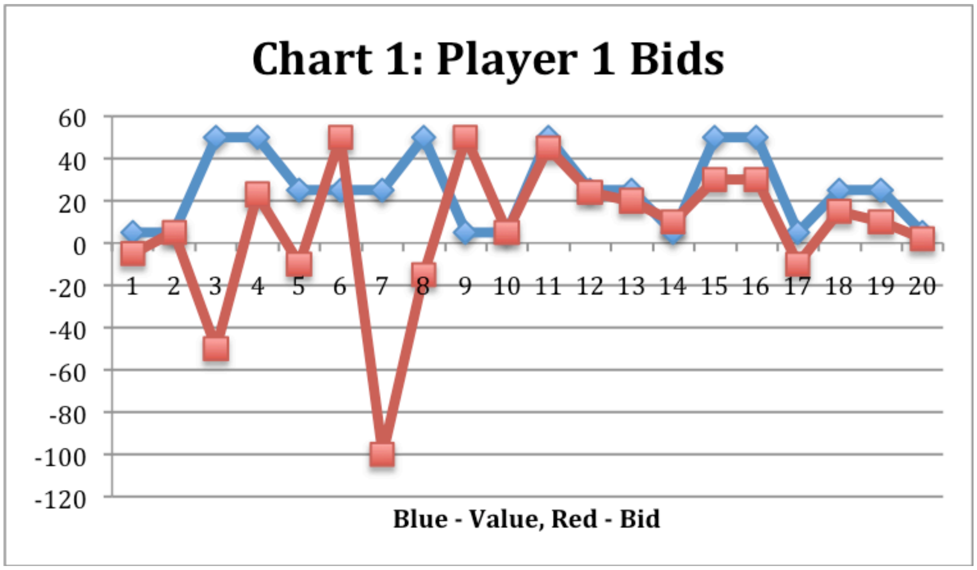
Considering how significant learning turned out to be, and that the minority group (whether by chance or otherwise) represented a very extreme group we cannot conclude that the treatment had any effect. Nothing can be said of any significance here about minority versus majority behaviour, nor fixed versus random minority behaviour. Further, given the similarity between the majority model and the all players model, we cannot conclude that the treatment had any effect upon the majority group either.

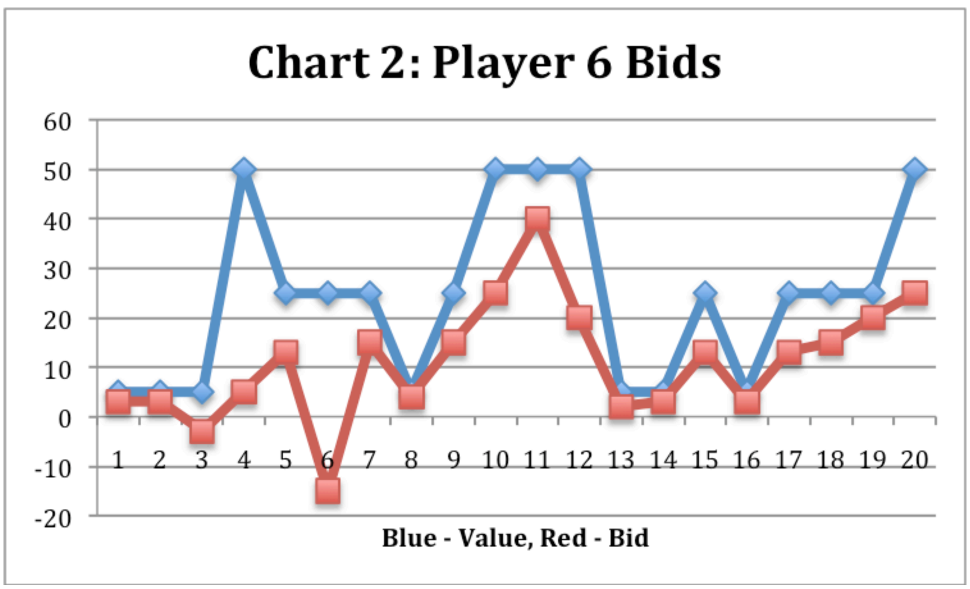
Result 2

Table 2: Round #15				
	Given value		Player's bids	
	red value	blue value	red value	blue value
Player #1	50		30	
Player #2	50		0	
Player #3		25		0
Player #4	50			50
Player #5	50			16
Player #6		25		13
Player #7	50			10
Player #8	50		5	
Player #9		25		15

If we look at this round, each player in the majority group is given value of 50 (highest value). Therefore we can anticipate that red will win in this round since red has a total value of 300, which is much greater than blue value of 75. The players that are given value of red will try to counter bid to make the highest payoff according to the calculation payoff = value + bid + compensation. This behavior can be observed from the above table that 4 out of the 6 players counter bid. In this case, we can conclude that the higher the value given to the majority group, the more likely the players will counter bid.

By and large, the above was the exception. First, because the highest value, 50 cents, only occurred in one-third of the rounds. Secondly, because players were learning from round to round. As in table 1, the counterbid coefficient decreases in nearly every case for the last ten rounds. Any increase in the value coefficient likely had more to do with players' bids correlating more strongly with the values than any increase in bids. Looking at charts 1 and 2, the synchronization between players bids and values which occurs around round 10 is fairly obvious. With player 6 it occurred earlier, which helps explain why player 6 had higher payoffs.





Also visible in charts 1 and 2 is the propensity of players to bid below their value to maximize their profits. This was referred to by Oprea et. al as "shading". It is likely the best strategy to play in the compensation election, as it guarantees some sort of payoff at low cost. In fact, shading is a best response when other players aren't shading, because that allows players who shade to obtain their preferred item for minimal cost, or to maximize the difference between total bids, which also increases the size of the compensation. It is not surprising at all that players would trend towards shading.

Conclusion

Our treatments with minorities proved to be largely inconclusive. Though it may be possible that the fixed treatment was having an effect, it is too difficult to distinguish it from the individual strategies employed by players. This does not rule out any future attempts. We suspect that a trying this treatment with more players and with more sessions. Also, it is absolutely necessary to ensure that players are experienced with the game to eliminate any learning effects. Our players clearly had not learned the game after three trial rounds. In Oprea et. al, they eliminated the first 18 rounds, which would have been ideal in our experiment as well.

We were largely successful in reproducing Oprea et. al's results with our final 10 rounds. Players learned to "shade" their values, bidding around half of their value. As noted in their paper, this is not especially desirable for providing public goods. In our experiment, when players shaded their bids, the presence of just a few players with unusual strategies can cause random results. If shading decreases in larger groups, as Oprea et. al found, then this is not such a great concern. But in real world situations, with real money, we wonder if a few wealthy individuals could cause random behaviour in the compensation election.

In conclusion, we agree with Oprea et. al that the compensation election in its current form could be of great use for limited application, such as dealing with eminent domain. In situations where compensation is desirable, but unknown, the compensation election appears to be the better choice than Varian's compensation mechanism for externalities. But we should shelve any thoughts of using it in place of democracy until more experiments test the sturdiness of the compensation election.

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Appendix A: Compensation Election Instructions

Page 1

This is an experiment in economic decision making. You will be paid based on your decisions in this experiment in cash when the experiment is finished.

If at any point in these instructions you have any questions, please raise your hand.

You will begin the experiment with 50 cents. If you pay close attention to these instructions you may earn significantly more than this.

Page 2

The experiment will be divided into periods. There are 9 total participants (including you) in this experiment.

Each period, you and the other participants will make decisions which will determine which of the two items will be consumed. Each round either the Red item or the Blue item will be chosen. Either everyone will consume the Red item, or everyone will consume the Blue item in a given period.

Your value for one or both of the items is shown the 'Submission' frame in the upper left portion of your screen.

Your task is to submit a bid for Red or for Blue. Your bid is the amount you are willing to pay to consume that item.

Page 3

At the end of each period, the bids will be totaled for each item. Whichever item has the higher total of bids will be chosen. Ties will be broken randomly. The results will be displayed on the right side of the screen.

If you have a value for the item that wins, you will receive that value. For example, if you have a value of 100 for Red, and Red receives the higher total of bids, you receive 100. If you have a value of 130 for Blue and Red receives the higher total of bids, you do <u>not</u> receive the value of 130.

Independent of the value of the items, if the item you bid on wins (receives the higher total of bids), you will pay the amount of your bid.

If the item you bid on loses (receives the lower total of bids), you will be paid the amount of your bid.

In sum, if you win you pay your bid, and if you lose, you are paid your bid.

You will also be paid a compensation from the difference between the total of winning and losing bids, multiplied by your share of the losing bids.

Page 4

To submit a bid, choose which item you wish to bid on and enter the desired amount directly into the bid box. Press the Submit button when you are satisfied with your submission. You can also Abstain from bidding in any period by clicking the Abstain button. This is equivalent to entering zero for both the Red and Blue item.

The potential earnings of a bid will be displayed in the 'Potential Profit' frame.

Page 5

To go on to the next period, you need to click the Ready to go on button in the summary information frame. Once everyone has clicked, the next period will begin. Your total cash will carry over from the previous period.

Summary

1. You will begin the experiment with 50 cents.

2. You will have values for Red or Blue each period.

3. You can submit a bid for either Red or Blue, but not both.

4. Which ever item has the greater sum of bids is chosen