# Endogenous Preferences and Conformity: Evidence From a Pilot Experiment

Sergio Beraldo
Department of Economics
and Statistics
University of Naples

Valerio Filoso
Department of Law
University of Naples

Marco Stimolo*
Department of Law
University of Naples

October 3, 2013

**Abstract**

Conformity behavior, i.e. the agreement between an individual's choices and the prevailing behavior of a reference group, is a commonly observed phenomenon. Though some types of social interactions may give raise to specific incentives to adopt either a majoritarian or a contrarian behavior, we want to investigate whether the same behavioral pattern emerges even when no economic motivator is present.

To accomplish this task, we employ an experimental Vickrey median price auction designed to provide incentives to reveal individual preferences truthfully. Whereas we feed the control group with just the median price, we give out additional information on other players' bids for those in the treated groups. These informations are designed to provide hints at revising individual bids.

Our main results point to a strong tendency of the individuals to adapt their behavior to those of the individuals which can be observed. Moreover, although a clear shaping effect (a regression toward the median price) does emerge for the control group, the provision of information about the actual behavior of a sample of the relevant group is able to minimize or neutralize the shaping effect. Specifically, we find that players adjust to a divergence between their bids and the average bid of a reference group by a factor of 47.4%—87.3%. These figures point to a relevant role for conformity in group behavior.

**Keywords**: Endogenous preferences, shaping effect, social conformity, Vickrey auction.
**JEL codes**: C91, C92, D44.

*Corresponding author. E-mail: stimolo@unina.it

# 1 Introduction

The existence of anomalies that are at odds with standard theories of preferences is well known (e.g. Allais (1953); Kahneman and Tversky (1979)), as it is well known that such anomalies tend to disappear in experimental repeated markets. According to Loomes et al. (2003), the vanishing of anomalies during repetition may be explained by grounding either in the hypothesis of context independent preferences (the *discovered preferences hypothesis* or one of its variant, e.g. the *market discipline hypothesis*) or in the hypothesis that preferences are endogenous to the institutions through which they are elicited (the shaping hypothesis). According to this latter hypothesis, due to the lack of well-articulated preferences any elicitation mechanism inevitably produces responses in which normatively irrelevant signals, i.e. signals not conveying any information on the individuals' actual satisfaction (e.g. the market prices) act as cues affecting the elicited values. Recent evidence has provided sound evidence in support of the Shaping hypothesis (Loomes et al., 2010; Tufano, 2010).

Grounding in Butler and Loomes (2007), in this paper we generalize the process of preference formation in response to cues accruing from the market by considering the *shaping effect* as a particular case of *conformity*, to be meant as an individual's intrinsic tendency to adapt her prior knowledge and behavior to the most frequent behavioral pattern in a population (Efferson et al., 2008).

Although there is widespread evidence of conformity both among human (Asch, 1956; Haun et al., 2013) and nonhuman animals (van de Waal et al., 2013; Morgan and Laland, 2012), quite surprisingly little attention has been paid to this phenomenon by scholars involved in the exogenous versus the endogenous preference formation dispute. [1] Our purpose is to fill this gap, by showing how conformity affects the outcome of an elicitation mechanism, even if there is no incentive for the individuals to conform.

We run an experiment based on a variant of the Vickrey auction (i.e. median price auction) to test how the information about the bidding behavior of a reference group affects the elicited values of the relevant individual.

Our main results point to a strong effect of conformity, that is a strong tendency to adjust the stated values to those of the individuals one can observe. Moreover, although a clear shaping effect emerges when no other information is being provided, the provision of information about the actual behavior of a reference group neutralizes the shaping effect. Specifically, we find that players adjust to a divergence between their bids and the average bid of a reference group by a factor of 47.4%—87.3%. These figures point to a relevant role for conformity in group behavior.

[1] Indeed, in standard economic literature (with due exception of Klick and Parisi (2008)) conformity is either the upshot of a rational calculation that takes into account the disutility deriving from punishment and social exclusion (Bernheim, 1998), or a way to economize on the costs of acquiring information (Bikhchandani et al., 1998). These stances are grounded in the assumption of an exogenously given set of well-defined preferences.

## 2 Experimental design

In the next section we briefly report the results from a paper and pencil pilot experiment which was conducted on the 30th June 2013, from 2.00 p.m. to 6.00 p.m., at the Department of Political Science of the University of Naples Federico II. All funding required to cover expenses and payments was provided by the authors. Recruitment was done by informally asking students attending either the course of economic policy or the course of civil law to participate in the experiment. Participation was voluntary and no fee was granted.

Subjects were involved in a variant of the Vickrey (1961) selling auction with the following characteristics. In each of eight market periods (rounds) subjects were asked to submit monetary bids corresponding to their willingness to accept an auctioned bad, 60 ml of an harmless but distasting mixture of Gatorade and Vinegar (Ariely et al., 2003). Before running the first market period subjects were asked to drink a 30 ml sample of the mixture. This was a necessary condition for participation.

Subjects bids were obtained through forms containing a a sequence of questions of the following kind: "Would you be willing to accept €$x$ to drink the liquid?" The values of $x$ ranged from a minimum of (€0.20) to a maximum of (€3.00). To any question of the sequence each individual could either answer yes or no before reporting the value of her highest rejected price — i.e., the maximum price at which she was not willing to drink the liquid — at the bottom of the form. In what follows we adopt the convention of identifying the highest rejected price of a given individual in a particular round as the bid of that individual in that round.

In each market period, the price was set in correspondence of the median bid. Subjects whose bids were lower than the market price could in principle obtain the auctioned bad receiving a payment in cash equivalent to the market price. At the end of any market period a random experiment determined with probability 0.15 whether that period was indeed relevant for trading. In that case, individuals reporting an highest rejected price lower than the market price were asked to drink the liquid with the promise of a payment in cash equal to the current market price at the end of the experiment. There was a total of seven relevant periods (two relevant periods both in the first and the third Sessions, three relevant periods in the second session). The first of the three experimental Sessions lasted about 45 minutes. Each of the last two lasted about one hour and a half. The average payment per subject was €2.70.

At the beginning of the experiment, the whole group made of 28 participant was summoned in the classroom and was randomly split into three groups of individuals (7, 9, 12), with the first group assigned to control and the others to the alternative treatments. The first experimental session involved the control group. The other participants were required to leave the classroom and to show up at the door separately at agreed times.

At the end of any market period the prevailing price was made public. It was written on the blackboard and any subject could observe it until the end of the following market period, when another price was established. This was the only information provided to subjects belonging to the control group.

Individuals belonging to the treatment groups were given additional information. In par-

ticular, subjects belonging to the first treatment group, whose bids were below (above) the market price at the end of the previous market period, could observe, from the third period on, all the bids below (above) the market price in that period. They could not infer who did a particular bid. Neither they were informed that only information of a given type was given to them. They simply received an additional sheet of paper in which it was stated that some of their colleagues had done the reported bids in the previous market period.

Subjects belonging to the second treatment group received additional information after the third period, when the distribution of the individuals' preferences should have been more stable. In particular, those making the 2nd and the 3rd lowest bids (resp. the 7th and the 8th highest bids) in the third market period, received, from that period on, information concerning the bids above (resp. below) the market price in the previous period.

In what follows, we will use the abbreviations: CG(Control Group), TG1(Treatment Group 1), and TG2(Treatment Group 2).

# 3 Results

The main descriptors of the experimental groups are collected in table 1, while the basic statistical tests for their mean and variance are reported in table 2. The values of monetary variables are expressed in euros.

## 3.1 Median price

**Finding 1 (Median price for CG and TG1)** *The median prices of CG and TG1 are identical.*

After the first round in which no previous median price was observable, both groups instantly converged to the median price of 2.8. This occurrence is particularly valuable, since it exposed CG and the TG1 to the same median market price, with the TG1 receiving just a single type of additional information. Basically, the contrast between TG1 and CG implements an almost ideal *ceteris paribus* condition, as it is evident in figure 3.

**Finding 2 (Sticky convergence of TG2 median price)** *The convergence of TG2's median price is slow.*

Though the median prices of CG and TG2 do converge, the speed of convergence of TG2 is remarkably slower: this happened only from the sixth round onward, whereas it happened four rounds before for TG1. This testifies how the treatment administered to TG2 exacerbates the tendency to taking into account the normatively irrelevant information derived by others' players bids.

## 3.2 Control group

The only information provided by the conductors to the control group was the median price which prevailed at the previous round. Rounds 3 and 6 were found relevant and winners were required to drink.

**Finding 3 (Shaping effect 1)** *The value of variance of the bids in the CG steadily declines across rounds.*

The graphical depiction of the standard deviation of the control group can be seen in figure 2. Its values range from 0.9 in the first round from 0.4 in the last one. This marked decline appears as a confirmation of the shaping hypothesis. This result qualifies the control group as an empirically valid counterfactual for the treated groups.

**Finding 4 (Shaping effect 2)** *The average value of bids in the CG steadily converges toward the market median price.*

This can be considered as sound evidence that the information on market median price, though not normatively relevant, strongly shaped individual bids.

## 3.3 First treatment group

The TG1 is our first treated group. All other conditions being equal to the control group, the TG1 was given additional information according to the following scheme:

1. the participants whose bids were *below* the market median price at the previous round were provided with anonymous information on bids *below* the market median price;
2. the participants whose bids were *above* the market median price at the previous round were provided with anonymous information on bids *above* the market median price;
3. the participants whose bids were *exactly equal* to the market median price at the previous round were given no additional information.

Our prior was that if a conformity effect were present, the provision of normatively irrelevant information should further increase (decrease) the average bids for the players above (below) the median. Since the median is an impersonal summary statistic for the distribution of bids, some bidders could be tempted to extract information from actual non-median bids and to revise their own bids accordingly. Therefore, we expected a higher variance for TG1 compared to CG, since the additional information was supposed to prevent full convergence toward the median price.

**Finding 5 (Variance of TG1)** *The variance of the TG1 is stationary, falling in the range of 0.8 to 1.0.*

Compared to the control group, the variance of the TG1 does not exhibit any tendence toward decline and remains substantially stable across rounds (see figure 2). The test for equality of variances proves that the variance for TG1 is 26% higher than the variance for the CG ($p$-value for the unilateral test equal to 0.038). Since the players with bids above (below) the median were given information on other fellow participants which also bid above (below) the median, this resulted in higher (lower) bids for their reference group. Across rounds, this resulted in nondecreasing overall variance of bids, which completely offsets the shaping effect.

## 3.4 Second treatment group

With our second treatment TG2 we intended to test whether conformity simply reinforces a previously stated preference, as in the case of TG1, or is it also capable of radically changing them. All other conditions being equal to the control group, the TG2 was provided with additional information which is somewhat symmetrical if compared to TG1:

1. the participants whose bids were *below* the market median price at the previous round were provided with anonymous information on bids *above* the market median price;

2. the participants whose bids were *above* the market median price at the previous round were provided with anonymous information on bids *below* the market median price;

3. the participants whose bids were *exactly equal* to the market median price at the previous round were given no additional information.

In the case of TG1, each non-median player was given information about her fellow players whose evaluations were included in the same half of distribution: the mean of these bids could be slightly higher or lower than her bid. By contrast, in the case of TG2, the mean of bids given as extra information was strictly lower for those who were above the median and strictly higher for those below the median. Also in this case, we expected that bidders would try to extract relevant information from a set of similar bids, resulting in lower (higher) bids for those above (below) the median and a lower overall variance compared to the CG.

**Finding 6 (Variance of TG2)** *Compared to CG, the variance of TG2 is strictly lower.*

Our prior was that if a strong conformity effect were present, the provision of this alternative kind of extraneous information should result in higher (lower) average bids for those who received information on bids above (below) the median and a lower overall variance compared to the CG.

This effect seems to be remarkably stable over the rounds, as depicted in figure 2: this graph shows a clear pattern, with the standard deviation of TG2 closely mimicking the time path of CG, except for a steadily lower value. The difference in variance is reported in table 2, with the overall variance of TG2 being 13,9% lower than the control group ($p$ =0.118).

## 3.5 Regression analysis

In a further evaluation of our hypothesis of pervasive conformity in the treated groups, we employ an econometric model to test the impact of normatively irrelevant information on the behavior of bidders. Specifically, we test whether the first difference in an individual's bids (namely, th term $b_t - b_{t-1}$) is responsive to the kind of information provided in the experimental setting. We run the following regression model, derived in a companion theoretical paper that can be asked directly to the authors:

$$b_t - b_{t-1} = \delta + \alpha \left(p_{t-1}^{\text{med}} - b_{t-1}\right) + \beta \frac{\bar{r}_{t-1} - b_{t-1}}{1 + \sigma_{t-1}^r} + \varepsilon_t \tag{1}$$

where $\delta$, $\alpha$, and $\beta$ are constants to be estimated, $p_{t-1}^{\text{med}}$ is the median price at previous round, $\bar{r}_{t-1}$ is the mean value of the bids provided as extra information, $\sigma_{t-1}^r$ is their standard deviation, and $\varepsilon$ is an i.i.d. error term.

The first term on the right side of eq. (1), $(p_{t-1}^{\text{med}} - b_{t-1})$ is the usual effect of *regression toward the median*, namely the shaping effect. As this difference grows positive, next round's bid is adjusted upward when $\alpha > 0$.

The term $\bar{r}_{t-1} - b_{t-1})/(1 + \sigma_{t-1}^r)$ captures the value of the additional normatively irrelevant information for a bidder, as provided under the form of a list of bids made by other players. It is measured by the simple distance between the mean of the bids provided as information to the bidders above and below the median, discounted by its standard deviation, which functions as a metric for the dispersion of the signal in the reference group. When $\beta > 0$ we find evidence of a conformity effect.

### 3.5.1 Estimation

Table 3 reports estimates results for the control group. In this case, the model estimated was simply

$$b_t - b_{t-1} = \delta + \alpha \left(p_{t-1}^{\text{med}} - b_{t-1}\right) + \varepsilon_t \tag{2}$$

since no additional information was given to any bidder, except for the median price. We find that bidders adjust their current bid by a factor of 38% of the difference between the previous round's median price and bid. This value will serve as a benchmark for the evaluation of subsequent treatment effects.

The results for the treated groups are reported in table 4. In the design of our empirical models we made two fundamental choices: which observations to include and which counterfactual to employ. In our design the median bidders did not receive any additional information besides the median price: consequently, the term $(\bar{r}_{t-1} - b_{t-1})/(1 + \sigma_{t-1}^r)$ is missing for them. To estimate our model, we implement two alternative specifications:

1. We set the observations for the median bidders equal to zero and added a dummy for being non-median. The results are reported in columns 2–5.

2. We excluded the observations for the median bidders altogether. The corresponding results are reported in columns 6–9.

Regarding the choice of an appropriate counterfactual, we estimated the models with and without median bidders using

1. a basic fixed effects panel estimator;

2. a fixed effects panel estimator that includes the basic control group CG as an additional counterfactual.

While the the first estimator is considered standard, the second one took explicitly advantage of the separate control group to maximize unbiasedness of results. To this extent, we matched every bid $b_t$ with the corresponding average bid at the same round for the control group, according to the following formula

$$\hat{b}_t = b_t - E\left(b_t^c\right)$$

where $E\left(b_t^c\right)$ is the average bid for the control group at round $t$. The resulting first difference in bids becomes

$$b_t - \hat{b}_{t-1} = \left(b_t - b_{t-1}\right) - \left[E\left(b_t^c\right) - E\left(b_{t-1}^c\right)\right]. \tag{3}$$

From this formulation it becomes clear that the observed first difference in bids is deflated by the corresponding change in the value of average bids in the control group. Any change in bids in the treated group that is related to the behavior of the control group is taken out by appropriate differencing.[2]

### 3.5.2 Results

Overall, the two alternative specifications with and without the median bidders display just trivial differences in the estimated coefficients, while using the definition of $b_t$ provided by eq. 3 — with and without an explicit counterfactual — does make a difference. Since using $\hat{b}_t$ in place of $b_t$ removes the variability due to the exposition of bidders to the median price, we find that the effect size of the first adjustment term is lower when we also use the CG. This pattern is present in both treated groups.

**Finding 7 (Shaping effect)** *The estimated shaping effect is small and noisy.*

[2] Estimation of eq. (1) using the standard fixed effect method can produce biased results since the term $b_{t-1}$ appears on both sides of the equation. To account for endogeneity, an Arellano-Bond type of estimation is in order. Our results show effects of roughly the same sign and order of magnitude of those obtained using the conventional fixed effect estimator. Nonetheless, the consistency of this class of estimators holds only for $n \to \infty$ and, given the small number of subjects involved in the pilot experiment, we have decided not to include the results of the Arellano-Bond estimation in the present paper and to defer a full exploration of the results as the data from the actual experiment will become available.

We find evidence of a shaping effect for the TG1. The estimated effect is positive, which reflects a tendency to adjust toward the median. Nonetheless, when we use the control group as a counterfactual, the size of the effect drops by 63%. In the TG2 the shaping effect appears extremely noisy, with $p$-values uniformly distant from conventional levels of statistical significance.

**Finding 8 (Conformity effect)** *The conformity effect is stable and stronger than the shaping effect, especially in TG2.*

Across all estimates, the effect of conformity is uniformly positive, though is more noisy in the TG1. The TG2, on the contrary, has coefficient values ranging from 87.3% to 47.4%: this means that bidders did react to divergences between their bids and the average value of bids provided to them as additional information, though this clue is definitely normatively irrelevant because of the peculiar design of this median price auction. Moreover, in the TG2 the effect size of conformity is always higher than the corresponding shaping effect. This result suggests that in this context, additional normatively irrelevant information does influence bidding behavior and that, comparatively, the provision of information about groups of bidders has a stronger effect than the median price. We consider this result as evidence showing the relevance of conformity over shaping.

# 4 Conclusion

In this paper we described the results from an experiment intended to test the differential impact of conformity and shaping behavior in the context of a median price auction. Using our control group, we found evidence supporting the shaping hypothesis: across rounds, the bids' variance steadily declines and the average bid converges toward the market median price.

Furthermore, we find evidence supporting the hypothesis of conformity in our first trated group, as the provision of additional normatively irrelevant information prevents variance's shrinking, making it stationary over repetitions. More specifically, the information on the bidding behaviour of other fellow participants located at the same side of the distribution, either above or below the median, has a stronger influence than the median price: this suggests that the shaping effect can be neutralized by some specific type of information.

In the second treatment group the bids' variance is strictly lower than the bids' variance for the control group. This implies that the information on the bidding behaviour of other fellow participants located on the opposite side of the distribution — i.e. above (below) the median if the relevant individual is below (above) the median — has a stronger effect compared to the median price. These results are confirmed by the estimates of our regression models which testify a stronger role for conformity compared to shaping.

# 5 Tables and graphs

## 5.1 Descriptive statistics

Table 1
Descriptive statistics

| | Experimental group | | |
|---|---|---|---|
| | **Control** | **Treatment 1** | **Treatment 2** |
| Average bid | 2.4 | 2.2 | 2.4 |
| Standard deviation | 0.7 | 0.9 | 0.6 |
| Median bid | 2.8 | 2.8 | 2.7 |
| Subjects | 7 | 9 | 12 |
| Observations | 56 | 72 | 96 |

Table 2
Tests of effect

| | | Mean[a] | | Variance[b] | |
|---|---|---|---|---|---|
| **(t)** | **(c)** | $\mu_t - \mu_c$ | $p$ | $\sigma_t/\sigma_c$ | $p$ |
| Treatment 1 | Control | -0.233 | 0.051 | 1.259 | 0.038 |
| Treatment 2 | Control | -0.015 | 0.449 | 0.871 | 0.882 |
| Treatment 2 | Treatment 1 | 0.219 | 0.039 | 1.446 | 0.000 |

[a] $H_0 : \mu_t - \mu_c > 0$.
[b] $H_0 : \sigma_t/\sigma_c > 1$.
All reported $p$-values result from the appropriate unidirectional test.

FIGURE 1
The value of average bids

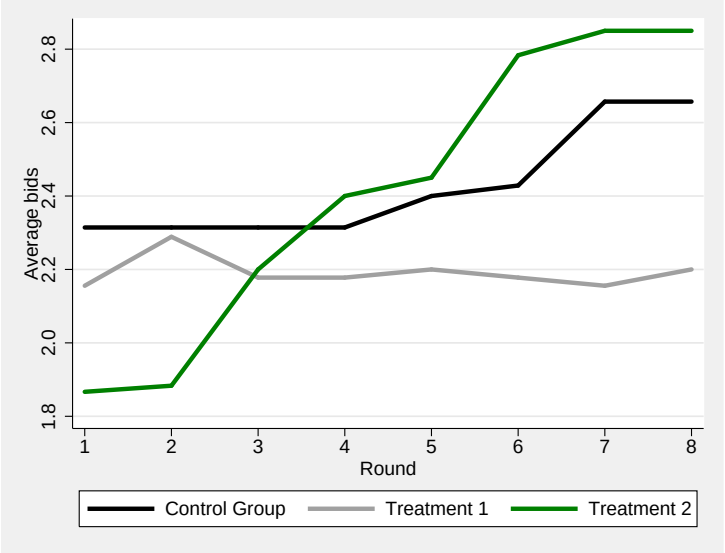



FIGURE 2
The standard deviation of bids

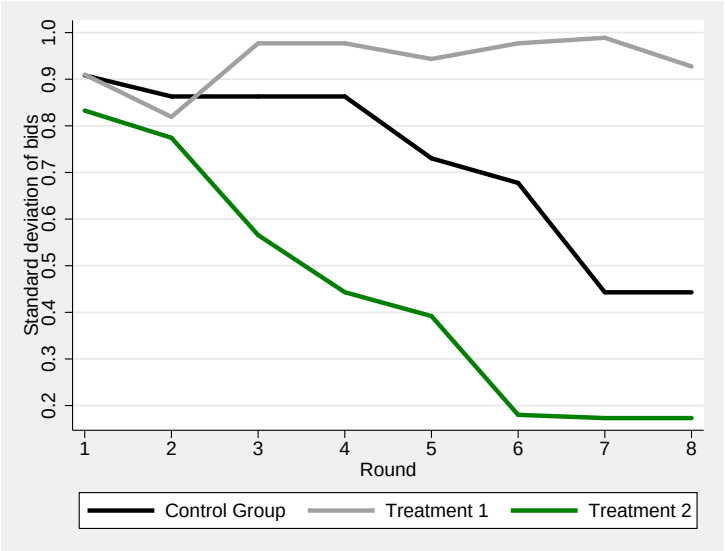


FIGURE 3
The market median bid

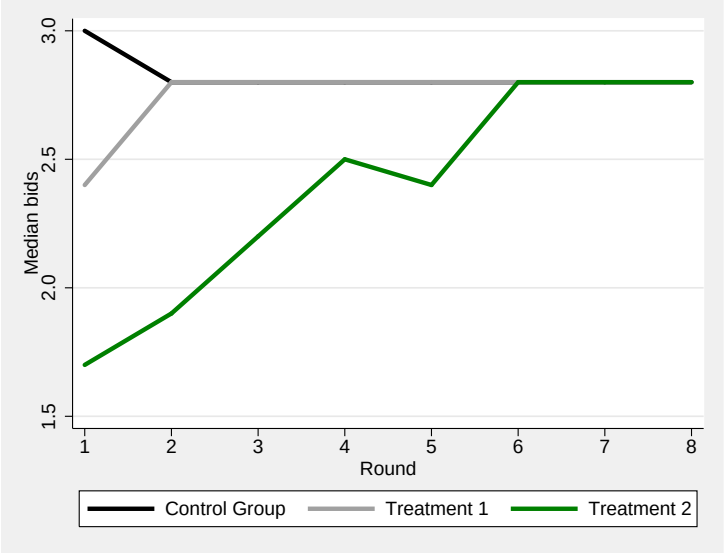
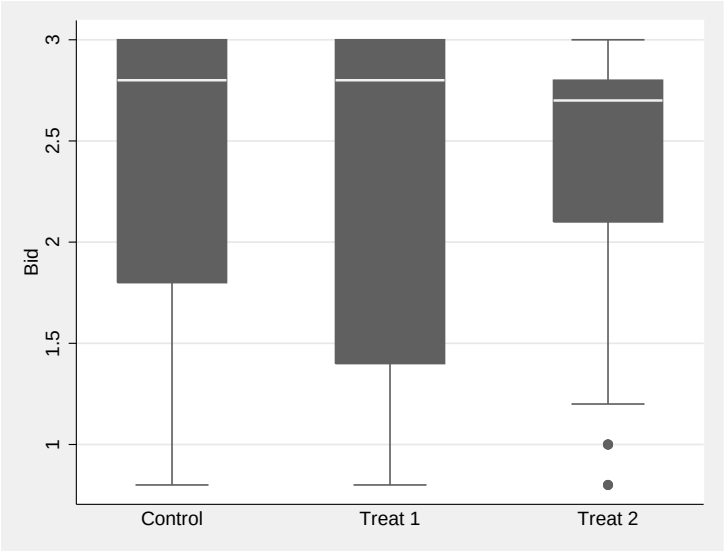



FIGURE 4
The boxplot of the three experimental groups



## 5.2 Regression models

TABLE 3
Partial adjustment model
Fixed effects estimation for control group

| **Variable** | Coef. | $p$-value |
|---|---|---|
| Adjustment term 1 | 0.380 | (0.000) |
| Constant | -0.031 | (0.191) |

[1] The dependent variable is $(b_t - b_{t-1})$, that is, the difference between current and previous bid for the $i$-th player. The subscript $i$ is omitted to avoid clutter.

[2] The first adjustment term is $(p_{t-1}^{\text{med}} - b_{t-1})$ reflecting the difference between previous stage's median price and player's bid.

TABLE 4
Partial adjustment model
Fixed effects estimation for treated groups

| | Complete group | | | | Without median bidders | | | |
|---|---|---|---|---|---|---|---|---|
| | No control | | Control | | No control | | Control | |
| **Treatment 1** | Coef. | $p$-value | Coef. | $p$-value | Coef. | $p$-value | Coef. | $p$-value |
| Adjustment term 1 | 1.039 | (0.000) | 0.341 | (0.014) | 1.039 | (0.000) | 0.389 | (0.015) |
| Adjustment term 2 | 0.117 | (0.507) | 1.169 | (0.000) | 0.117 | (0.510) | 1.096 | (0.001) |
| Dummy for additional info provided | 0.008 | (0.743) | -0.237 | (0.000) | | | | |
| **Treatment 2** | | | | | | | | |
| Adjustment term 1 | -0.518 | (0.252) | -0.036 | (0.840) | -0.539 | (0.475) | -0.131 | (0.814) |
| Adjustment term 2 | 0.783 | (0.004) | 0.474 | (0.000) | 0.873 | (0.337) | 0.627 | (0.006) |
| Dummy for additional info provided | 0.113 | (0.091) | 0.162 | (0.013) | | | | |

[1] The dependent variable is $(b_t - b_{t-1})$, that is, the difference between current and previous bid for the $i$-th player. The subscript $i$ is omitted to avoid clutter.

[2] The columns with the heading *No control* display models employing just the data from the treated group, whereas the columns with the heading *Control* display models obtained using the control group as an independent counterfactual.

[3] The first adjustment term is $(p_{t-1}^{\text{med}} - b_{t-1})$ reflecting the difference between previous stage's median price and player's bid.

[4] The second adjustment term is $(\bar{r}_{t-1} - b_{t-1})/(1 + \sigma_{t-1}^{r})$ reflecting the difference between previous stage's average price information provided and player's bid, discounted by the standard deviation of price information provided.

[5] All reported $p$-values bootstrapped with 1,000 repetitions.

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