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Less is more: A Field Experiment on Matching

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Abstract

We run a field experiment to test the truth-telling rates of the theoretically strategy-proof Top Trading Cycles mechanism (TTC) under different information conditions. First, we asked first-year economics students enrolled in an introductory microeconomics unit about which topic, among three, they would most like to write an essay about. Most students chose the same favorite topic. Then we used TTC to distribute students equally across the three options. We ran three treatments varying the information the students received about the mechanism. In the first treatment students were given a description of the matching mechanism. In the second they received a description of the strategy-proofness of the mechanism without details of the mechanism. Finally, in the third they were given both pieces of information. We find a significant and positive effect of describing the strategy-proofness on truth-telling rates. ON the other hand, describing the matching mechanism has a significant and negative effect on truth-telling rates.

1. Introduction

Until recently it was accepted in the school choice literature that strategy-proof mechanisms perform well in the laboratory, mostly due to the seminal papers by Chen and Sönmez (2002, 2006). This has been used as evidence to convince school districts to adopt strategy-proof mechanisms like Deferred Acceptance (DA) or Top Trading Cycles (TTC). However, the laboratory and real-life implementations of matching mechanisms often differ in terms of the information available to participants. That is, experimental subjects are generally given a very accurate, if not cumbersome, description of the mechanism together with a solved example. In a sharp contrast, participants in real markets are generally kept ignorant about the algorithm mechanics. On the other hand, experimental subjects are typically not directly informed of the properties of the mechanism (strategy-proofness, incentive compatibility, stability, etc.) while participants in real-life markets are often told about strategy-proofness in one way or another. For instance, both the Boston Public Schools system (Boston Public Schools, 2014) and the New Orleans Recovery District (Vanacore, 2012) inform participants that the best they can do is report their true preferences.

In this paper, we report the results of the to our knowledge first field experiment on matching. We run a TTC-based, in-class topic allocation task to compare three treatments that differ in the information given to participants: an only “mechanism description” (MD), only “properties description” (PD), and both “mechanisms and properties descriptions” (MPD). The aim of the experiment is to assess which informational structure generates the highest truth-telling rate.

The experiment was run as a classroom procedure in a first-year introductory microeconomics class at the University of Sydney. As part of the course assessment, students had to write an essay about the structure of one of three markets: smartphones, TV sets or scanners. We simply elicited student’s actual first preference by asking them to nominate their favorite topic (smartphone, TV set, scanner) through the online course management website. The vast majority of students chose the smartphone. Then students were told in class that the topics had to be evenly allocated: one-third of the students to each topic. They were also told that to achieve this goal a matching mechanism would be used. Each one of the three streams of the course received the instructions for one of the three treatments.

We find that describing the properties of TTC² leads to a significantly higher rate of truthful reporting, but a description of the mechanism itself leads to a lower rate of truthful reporting. That is, a *less* cumbersome explanation generates *more* truth telling.

2. Literature review

The efficiency concern in one-sided matching markets led to the adaptation of Gale's TTC mechanism to solve the school choice problem. Abdulkadiroğlu and Sönmez (2003) shows that TTC is both Pareto efficient and strategy-proof. Chen and Sönmez (2006) pitched TTC against DA (non-Pareto efficient but strategy-proof) and the Boston mechanism (BOS) (non-strategy-proof but Pareto efficient) in an experimental laboratory. They found that the strategy-proof mechanisms TTC and DA outperform BOS regarding truth-telling. They also found that the most common source of preference misrepresentation is a district school bias (DSB). That is, ranking the pre-assigned school for which the applicant has a priority higher in the submitted preference list than it is in reality. Pais and Pintér (2008) found that TTC outperforms DA and BOS with respect to the criterion of truthful preference revelation in all the informational settings tested. However, they also demonstrated that the additional information leads to higher rates of preference misrepresentation in all three mechanisms. Klijn et al. (2010) compared BOS with DA, devoting special attention to individual behavior. In particular, they include a simple lottery to elicit risk aversion. They found a positive correlation between risk aversion and the probability to play *protective* (out-of-equilibrium in any case) strategies under DA.

The early literature on experimental matching suggests that the high truth-telling rates found for strategy proof mechanisms, TTC in particular, are a result of participants' understanding the incentive structure of the experiments.⁴ The standard experimental instructions were therefore deemed transparent enough. Nevertheless, school districts rarely provide any explanation of the matching mechanism they use. For instance, the San Francisco Unified School District (SFUSD) started using TTC in 2012 for the school choice program but provided very little detail about the mechanism itself (Roth, 2011). Recently, the New Orleans Recovery District adopted TTC for student assignment (Hakimov and Kesten, 2014). In New Orleans, a sketch of TTC's mechanics was only made available to the public once through a poster published by the local newspaper (Vanacore, 2014). The initial DA implementation of the BPS match used to offer a detailed

² We use "properties description" and "advice" as interchangeable terms.

⁴ Chen and Sönmez (2006) claims that, if it weren't for a minority of confused participants who manipulate their rankings, truthful revelation would be universal.

explanation of DA together with seminars for curious parents. Nowadays, the BPS website only includes a faint mention to strategy-proofness, but no procedural explanations. In summary, school boards consistently avoid giving descriptions of the matching mechanism used. The first aim of our experiment is to investigate the consequences of this choice in the design of real markets.

All of the experimental studies mentioned so far make use of a detailed description of the mechanism in the experimental instructions, but they don't provide a description of the mechanism's properties. Explaining the properties of the mechanisms in the lab might help to overcome the gap with the field, but it could easily lead to methodological problems like demand effects and/or confusion. Nevertheless, a growing stream of the literature adds advice to matching experiments. For instance, Guillen and Hing (2014) provide experimental evidence that wrong third-party advice can easily mislead participants and result on very low truth-telling rates in the lab. Ding and Schotter (2014a) finds that chatting in between two DA matching markets does not increase truth telling rates. Ding and Schotter (2014b) finds that after 20 rounds of intergenerational advice truth telling decreases dramatically from above 70% to about just 45%. The three previous papers⁵ give a clear indication of truth-telling not being driven by transparency of the experimental instructions.⁶ The next question to ask is whether correct advice can induce participants to make the right choices. Braun et al. (2014) reports some success in this direction: it includes correct advice in the experimental instructions which helps subjects to behave optimally. Is it possible to obtain positive results in the field? The second aim of the current paper is testing the effect of strategy-proofness advice in a controlled natural environment.

3. Experimental design and procedures

We design a natural experiment to compare the behavior of students in a matching market under different information conditions. That is, we vary across treatments the explanation of the allocation procedure and the presence of advice.

⁵ Not only those, but also Pais and Pintér (2008) or Klijn et al. (2010).

⁶ An alternative explanation for the high truth telling rates in early matching experiments could be a massive demand effect stemming from induced preferences.

3.1 Preliminaries

Students of an undergraduate introduction to economics class had to write an essay about market structure. In the essay, they had to answer a series of questions to argue whether the market for a particular product approaches perfect competition, a monopoly or an oligopolistic structure. There were three possible products to write about (smartphone, TV set, and scanner) but other than for the product (or topic) the assignments were identical. More than 700 students were enrolled in the course which was taught across three streams. The essay mark was worth 15% of the final mark for the course.

The main challenge for the design of a field matching experiment is the elicitation of the true preferences of participants. We worked around this limitation in the following way: in Week 5 the lecturers announced that the students had to write an essay for which there were three available topics. Students were asked to submit their favorite topic through the online course management system. There is no reason to assume any preference manipulation at this stage.⁸ Our method does not elicit the full preference list of students, but knowing the true top choice allows for a sufficiently rich analysis.

The selection of topics resulted in a high correlation in preferences (see Figure 1), a sizeable majority of students reported the smartphone as their true top choice. The use of a matching mechanism to evenly allocate topics was therefore justified.

⁸ In previous years there were no topic choices but only one assigned topic. Thus a possibility of learning from previous cohorts, or inferring any experiment-related knowledge, is excluded.

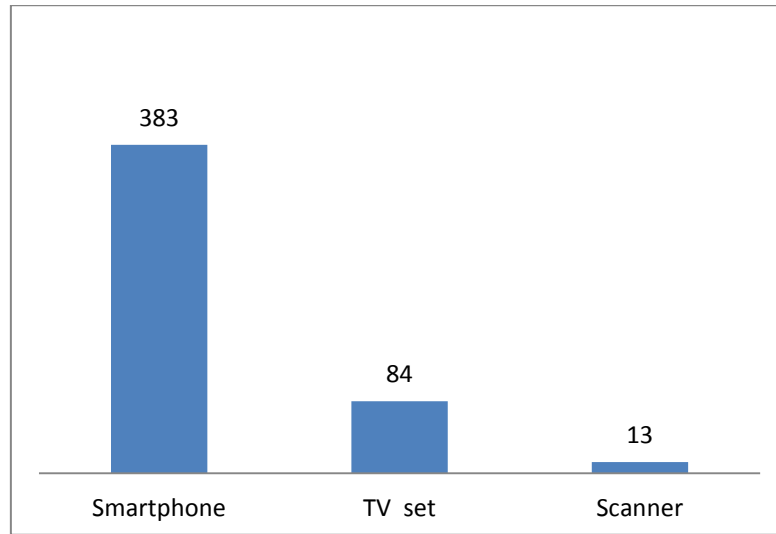


Figure 1: Distribution of favorite topics

3.2 Procedures

The allocation of the topics to students was done through the TTC mechanism for the topic allocation problem, which is a direct reformulation of TTC for the school choice problem by Abdulkadiroğlu and Sönmez (2003). In the case of the topic allocation task the modifications are straightforward. Each student has to be assigned to one of the three topics. Additionally, there is a maximum number of students who can be assigned to each of the topics, corresponding to the number of slots in schools in the original formulation. Each topic has priorities over all students (the introduction of priority groups and the transition into strict priorities are discussed later in this section).

The three experimental treatments took place at the beginning of the corresponding Week 6 lecture for each of the three streams, exactly one week after the topics had been announced and just a couple of days after the deadline for reporting the choice through the class administration system. At the beginning of the class the lecturer announced that the distribution of submitted choices was skewed too much in favor of one topic (without mentioning which topic) and that there should be an approximately equal division of the topics among students. For that reason he announced that an allocation procedure would be implemented. Then the students had 10 to 15 minutes to read the instructions for the

allocation mechanism and write down their preference order of the three topics.⁹ We distributed the instruction and decision sheets. Students were asked to write their student ID at the top of the sheets.

Priorities for students for topics were generated as an analogue of the district school priority. Every student received a priority for one of the topics. The priority topic was written at the top of the instruction page and was called “Tentative topic.” The allocation of tentative topics was random. The ties inside the same priority group as well as ties for non-priority students were broken randomly in the process of the topic allocation and the students were informed about it.

3.3 Treatments

In all treatments students received the instruction and decision sheets including their tentative topic.

The mechanism description treatment (MD)

In this treatment the instructions included an explanation of the TTC mechanism framed in the language of the topic allocation problem. We used a formulation similar to Chen and Sönmez (2006). The instructions for all treatments can be found in the online Appendix. The MD treatment is therefore very close to the typical laboratory setup.

The properties description treatment (PD)

In this treatment, the instruction sheet does not include any explanation of the TTC mechanism but a description of the properties of the mechanism as follows:

“Each participant is first randomly assigned a tentative topic. Your tentative topic is _____ (This assignment is random). You will be asked to submit Decision Sheet rankings, which are used to determine the final allocation. For these purposes we will use the Top Trading Cycles Mechanism.¹⁰ This mechanism takes into account your preferences and

⁹ The instructions of all treatments as well as the ranking list that had to be submitted fitted to one A4 sheet. (For MD and MPD the sheet was double-sided). Thus, each participant had to read only one or two pages and submit her choice on the same paper sheet. For details check instructions in Appendix.

¹⁰ We use the name of the mechanism to sound more scientific for the students, and also to be verifiable. We assume that none of the first-year students are familiar with the mechanism.

the preferences of others in order to provide as many top choices as possible and it is strategy proof. Thus, every participant has no incentive to misrepresent her preferences, as no matter what other subjects do, she is always better off by submitting true ranking lists.”

The mechanism and properties description treatment (MPD)

This treatment is the aggregation of the two previous treatments. Students received the instructions from MD with a typical TTC explanation and then, just like in PD, received the description of its properties at the end of the instructions.

3.4 Sessions

All the three sessions were run on April 18 and 19, 2013. We ran just one session per treatment, corresponding to one of the three streams. The MD treatment was run at the beginning of the 2pm to 4pm class on April 18. PD was run at the beginning of the 4pm to 6pm class on the same day. The MPD treatment was run the next day at the beginning of the 9am to 11am class. The order of the sessions and the relative short time frame allowed us to assume the minimum possibility of information transfer between students from different streams¹¹.

Topics were allocated by inputting the submitted rank order lists to our custom-made TTC software and students were notified of their topic assignment on the Monday after the classes, April 22. Those students who did not show up to the class and thus did not submit their rankings were automatically allocated to the under-demanded topic.

A total of 505 students submitted their decision sheets with a rank list. We are able to use only 480 of them as 35 students who submitted a rank list in the classroom had failed to previously submit their favorite topic choice through the online system. As student attendance across streams was not uniform we ended up with 261 observations in MD, 106 in PD, and 113 in the MPD treatment.

¹¹ The classes of MPD and PD treatments were in the same classroom one after another. There is short break between the end of the first class and the beginning of the second in which students rush to get to their next class. We did not observe any interaction between students of two streams.

3.5 Behavioral predictions

Strategy-proofness predicts that all students should report truthfully and should thus state their online favorite choice according to the online survey as the top choice in the rank list submitted in the classroom.

We believe that the complexity of the class submission task varies remarkably across tentative topics. The students whose tentative topic is their elicited favorite topic face a *trivial* decision which does not require much understanding of the mechanism properties. According to the data submitted online, the smartphone is clearly the most popular topic, thus, getting the smartphone as a tentative topic makes the decision trivial with a high probability.

Students whose tentative topic is the least preferred topic are in a nothing-to-lose situation. It is hard to find a behavioral justification to rank the scanner, the seemingly overall least favorite topic, first in this situation.¹²

The decisions of students who received the TV set as a tentative topic are the most interesting from a behavioral perspective. Most likely and according to the online survey, the TV set was their second choice. These students are exposed to similar behavioral trade-offs as participants in the lab experiments with the district school being close to the top true choice, a situation in which DSB becomes relevant. If a student did not understand or trust the advice on strategy-proofness, she is likely to think that stating the true ranking list can lead to the loss of the priority for the second best topic and thus risk ending up with the least preferred topic.

Therefore we hypothesize that students with the TV set as their tentative topic are more likely to misreport their top choice when submitting their rank list. We expect, in this case, to observe behavior in line with DSB as in, for instance, Chen and Sönmez (2006). In our context we'll call this behavior *tentative topic bias (TTB)*. That is, a student misreports her true top (favorite topic) choice by submitting the tentative topic at the top of the ranking list.

¹² That could happen if the student actually likes the scanner best, which is quite unlikely given the survey. Note that students who got the scanner as their tentative choice might still lie about the way they rank the TV set vs the scanner. Our design does not allow for detecting these manipulation attempts. The situation is similar in Guillen and Hakimov (2014) where the local school was the least preferred school by design and therefore only 2% of subjects did not play the district school bias.

We also hypothesize that the description of properties given to students in MP and MPD should increase the number of truthfully stated top choices by students. Note that in a field experiment such as ours advice comes from a reputable source, the lecturer, and therefore it has a better chance of succeeding than in previous laboratory experiments.

4. Results

Result 1: *Across the three treatments, 13.5% of subjects in the experiment misrepresented their top choice. Misrepresentation reached 18.8% in the MD treatment.*

Support: Table 1 shows the frequency and the corresponding percent of the misrepresentations of the top choices by students by treatment. The exact Fisher test for the equality of proportions of the students who misrepresent their preferences provides the following p -values for one-sided tests: $p = 0.00$ for MD versus PD; $p = 0.01$ for MD versus MPD treatment; $p = 0.26$ for PD versus MPD treatments.

Table 1. Misrepresentation rates by treatments

treatment	Number of subjects	Number of top choice misrepresentations	% of misrepresentations
MD	261	49	18.8%
PD	106	6	5.7%
MPD	113	10	8.8%
Total	480	65	13.5%

The truth-telling rate for the MD treatment is the lowest among our treatments, but it is higher than in Chen and Sönmez (2006) (59% of misrepresentation in the random environment and 50% in the designed). We used Chen and Sönmez's (2006) formulation of TTC, but we cannot claim that in the natural environment subjects tend to report more truthfully than in the laboratory: the high truth-telling rate is driven by the students facing a trivial decision.¹³ Excluding them, misreporting in MD reaches 28%, which is very much in line with Chen and Sönmez's results.

¹³ Trivial decisions are of course ruled out by design in laboratory experiments.

Result 2: *The vast majority of subjects report a truthful top choice when they face a trivial decision.*¹⁴

Support: Only 3 out of 176¹⁵ students facing a trivial decision misreported their top choice in the experiment. The binomial probability test rejects the null hypothesis that the proportion of representation is higher than 5% ($p=0.02$) and thus we conclude that students reporting under a trivial decision situation is in line with our hypothesis. Trivial decisions are indeed trivial.

Next we look at the truth-telling rates by tentative topics.

Result 3: *The proportion of misreported top choices is the highest among students with a TV set as a tentative topic, the second highest among students who have the scanner as a tentative topic and the lowest among students with the smartphone as a tentative topic. All those differences are significant at the 1% level.*

Support: The last section of Table 2 (rows 13 to 16) presents the number of misreported choices and the proportion of truthful reporting for tentative topics. The exact Fisher test for the equality of proportions of the misreported top choices provides the following p-values for a one-sided test: $p = 0.00$ for smartphones versus TV set; $p = 0.00$ for smartphone versus scanner treatment; $p = 0.00$ for TV set versus scanner.

Thus, we find clear support of our hypothesis: students with the TV set as a tentative assignment are significantly more likely to misrepresent their top choices. Additionally, we are able to differentiate between misrepresentations of students in the form of TTB and other misrepresentations.

¹⁴ Note that this result can be seen as a manipulation check for our top choice elicitation method.

¹⁵ Two of these subjects were in the MD treatment and one in the MPD treatment.

Table 2. Summary of submitted choices

	<i>MD</i>	N	Number of misrepresentations of the top choice	Number of students affected by TTB	Proportion of truth
1	Smartphone	85	4	4	95.29%
2	TV set	93	31	30	66.67%
3	Scanner	83	14	5	83.13%
4	Total	261	49	39	81.23%
	<i>PD</i>	N	Number of misrepresentations of the top choice	Number of students with TTB	Proportion of truth
5	Smartphone	37	1	1	97.30%
6	TV set	40	3	3	92.50%
7	Scanner	29	2	0	93.10%
8	Total	106	6	4	94.34%
	<i>MPD</i>	N	Number of misrepresentations of the top choice	Number of students with TTB	Proportion of truth
9	Smartphone	35	0	0	100.00%
10	TV set	40	9	8	77.50%
11	Scanner	38	1	0	97.37%
12	Total	113	10	8	91.15%
	<i>All treatments</i>	N	Number of misrepresentations of the top choice	Number of students with TTB	Proportion of truth
13	Smartphone	157	5	5	96.82%
14	TV set	173	43	41	75.14%
15	Scanner	150	17	5	88.67%
16	Grand Total	480	65	51	86.46%

Note: The table is grouped in 4 blocks by treatments. “N” in the second column represents the number of students with a given tentative topic.

Result 4: *TTB explains 78% of all the misrepresentations of top choices. TTB explains 5 out of 5 (100%) misrepresentations for the smartphone. TTB explains 41 out of 45 (91%) misrepresentations for the TV set. TTB explains only 5 out of 17 (29%) misrepresentations for the scanner.*

Support: Column 4 of Table 2 presents the number of misrepresentations when the reported top choice is the tentative topic. In line with our hypothesis TTB most often occurs in the case of the TV set as the tentative topic, as students understand that they can guarantee themselves their most probable second choice by reporting the tentative topic as a top choice, thus escaping the worst option (scanner). The misrepresentations of preferences among students with the scanner as the tentative topic are harder to explain, but most likely they just skip the top choice, hoping that their chances of receiving the second choice are then higher. These students would not like to be assigned to their tentative topic and thus aim for the middle

option. However, we cannot claim the latter with certainty as we know only the true top choice of the students.

As discussed previously, the most interesting group of students are those with the TV set as the tentative topic, as they are more likely exposed to TTB. To make a fair comparison, we consider only students for whom the decision is non-trivial, as otherwise the difference among the truth-telling rates could be driven by the unequal distribution of students with trivial situations across the treatments.

Table 3. Preference reporting for students with TV set as the tentative topic, non-trivial decision

Treatment	Students with non-trivial decisions	Number of mis-reported top choices	Percent of mis-reported top choices	Proportion (Fisher exact) test p-value versus MD	Proportion (Fisher exact) test p-value versus PD	Proportion (Fisher exact) test p-value versus MPD
MD	73	30	41%		0.00 (0.00)	0.04 (0.07)
PD	30	3	10%	0.00 (0.00)		0.07 (0.12)
MPD	33	8	24%	0.04 (0.07)	0.07 (0.12)	

Note: Column 4-6 present the test for equality of proportion of truth-telling rates by treatments. Two-sided p-values of the proportion test are presented, followed by two-sided p-values for the Fisher exact test for the equality of proportions in parenthesis.

Result 5: *The proportion of students who misreport when the TV set is their tentative topic and they face a non-trivial decision, is the highest in MD, the second highest in MPD, and the lowest in PD. All the differences are statistically significant.*

Support: Column 4 of Table 3 reports the percentage of misreported top choices for students with TV set as a tentative topic among students with a non-trivial decision by treatments. The difference in the proportions of the misreported top choices between MD and PD treatments is significant at the 1% level; between MD and MPD treatments at the 5% level; between PD and MPD treatments at the 10% level (see columns 5–7 of Table 3 for the p-values of one-sided proportion tests).¹⁶

Next we use Probit regressions to test jointly the effects of both properties and the mechanism description.

¹⁶ p-values differ for the Fisher exact test. The comparison of PD and MPD gives the p-value of 0.12. We still report the 10% significance of the result due to the high conservatism of the Fisher test.

Result 6: *The properties description increases the truthful reporting of the top choice. Conversely, describing the mechanism decreases the truthful reporting of the top choice. When including both variables at the same time, the properties description variable remains significant for the whole sample, while the mechanism description variable remains significant only when the sample is restricted to students with the tentative topic “TV set.”*

Support: Table 4 presents Probit regressions predicting the misrepresentation of the top choice by students under different specifications. We generate two dummy variables. “Properties description” equals 0 for the MD and 1 otherwise. Mechanism description equals 0 in PD and 1 otherwise.

Result 6 is the main result of the paper. We show that in our field experiment with student participants, who on average should be much better at understanding the mechanism than the general public, the explanation of the properties does matter for the successful practical implementation of a market. On the other hand, the explanation of the procedures of matching mechanism, the instructions, has a clear negative effect. We conjecture that this effect could be the result of participants being confused, and thus believing to understand more than they actually do. Such individuals could try to outsmart the mechanism even in the presence of advice.

Table 4. Probit regression for misreported top choices

Dummy for misreported top choice	Aggregated data			Tentative assignment is TV-set		
	(1)	(2)	(3)	(4)	(5)	(6)
Properties description	-0.605*** (0.167)		-0.506** (0.201)	-0.629*** (0.225)		-0.355 (0.264)
Mechanism description		0.608*** (0.230)	0.234 (0.277)		0.944*** (0.33)	0.693* (0.380)
Trivial situation	-1.318*** (0.25)	-1.308*** (0.250)	-1.322*** (0.251)	-1.104*** (0.360)	-1.115*** (0.371)	-1.123*** (0.369)
Constant	-0.594*** (0.102)	-1.334*** (0.214)	-0.828*** (0.294)	-0.257* (0.146)	-1.303*** (0.307)	-0.948* (0.405)
N	480	480	480	173	173	173
log L	-161.98	-165.00	-161.62	-86.98	-86.14	-85.22
Pseudo R ²	0.15	0.13	0.15	0.10	0.11	0.12

Note: Values in parentheses represent standard errors. * p<0.1, ** p<0.05, *** p<0.01

5. Conclusion

We obtained overall high rates of truthful preference revelation in our field experiment. Nevertheless, this result is driven to a large extent by a substantial proportion of participants making a trivial decision. When the decision is non-trivial, that is, when the student is tentatively allocated her second best choice, truthful preference revelation is significantly lower and in line with previous laboratory experimentation. Furthermore, truth-telling in non-trivial decisions does not differ from truth-telling in trivial decisions when only advice about the properties of the mechanism is given. Conversely, truthful preference revelation is much lower in non-trivial decisions when only the mechanism description is provided. We obtain an intermediate result when both mechanism description and properties are provided.

We can therefore conclude that providing a description of the mechanism, identical to the standard TTC experimental instructions, has a detrimental effect on truth-telling. That is, the standard experimental instructions are not transparent, strategy-proofness is hard to infer from them, and confused participants try to manipulate the mechanism. The good news is that providing advice about strategy-proofness (properties description) seems to work well. This result stands in apparent contrast with previous research by Guillen and Hing (2014) and Ding and Schotter (2014), in which correct advice does not have a significant effect on truth telling. We believe that the difference can be explained by the reputation of the source of advice. Indeed, Guillen and Hing (2014) uses stylized advice from Internet sources and Ding and Schotter (2014) relies on advice from other participants. In our field experiment students obtain advice from their lecturer, a trustworthy source regarding classroom procedures.

Like our field experiment, real-life markets based on strategy-proof mechanisms both rely on advice about strategy-proofness and avoid describing the mechanism. The result of our experiment gives strong support to this practice. Most likely, the key to success rests on the reputation of the source of advice. Distrust on the School Board, or more generally on the institution organizing the market and providing advice, may well end up in less efficient outcomes. Market designers should take good note.

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Appendix

Experimental instructions and decision sheets.

MD treatment:

SID _____

Tentative topic: Smartphone

Please read instructions before submitting your preferences:

The first best topic _____

The second best topic _____

The third best topic _____

We will use the following procedure to allocate topics to students:

Each participant is first randomly assigned a tentative topic. **Your tentative topic is Smartphone.** You will be asked to submit Decision Sheet rankings, which are used to determine mutually beneficial exchanges between two or more participants. The order in which these exchanges are considered is determined by a fair lottery. This means each participant has an equal chance of being the first in line, the second in line, ... , as well as the last in line. The lottery will be run by computer and no one will know the outcome of it before making the decision.

The specific allocation process is explained below.

1. All participants are ordered in a queue based on the order in the lottery.
 2. Next, the participant at the top of the queue applies for the topic of his top choice, based on her ranking list.
 - If she applies for her tentative topic, she is assigned to the topic and this assignment is finalized. The participant and her assignment are removed from subsequent allocations. The process continues with the next participant in line.
 - If she applies for a topic which is different from her tentative assignment, the procedure moves as follows:

- Say applicant Claudia's tentative topic is "topic A" and she is applying for "topic B." Then one of the students who is tentatively assigned topic B has to be chosen. In particular, among all these students we choose the student who is the first one in the queue. Then this student is moved to the top of the queue directly in front of the requester (Claudia).

3. Whenever the queue is modified, the process continues similarly: the participant at the top of the queue applies for the topic of his top choice, based on her ranking list.

- If she applies for her tentative topic, she is assigned to the topic and this assignment is finalized. The process continues with the next participant in line.

- If she applies for another topic, say "topic C," then we follow the procedure explained in the example with Claudia: the first participant in the queue who is tentatively assigned topic C is moved to the top of the queue directly in front of the requester.

4. A mutually-beneficial exchange is obtained when a cycle of applications are made in sequence, which benefits all affected participants, e.g., I apply for Stefan's tentative topic, Stefan applies for your tentative topic, and you apply for my tentative topic. In this case, the exchange is completed and the participants as well as their assignments are removed from subsequent allocations.

5. The process continues until all participants are assigned a topic.

PD treatment

SID _____

Tentative topic: Smartphone

Please read instructions before submitting your preferences:

The first best topic _____

The second best topic _____

The third best topic _____

We will use the following procedure to allocate topics to students:

Each participant is first randomly assigned a tentative topic. Your tentative topic is **Smartphone (This assignment is random)**. You will be asked to submit Decision Sheet rankings, which are used to determine final allocation. For these purposes we will use the Top Trading Cycles Mechanism. This mechanism takes into account your preferences and the preferences of others in order to provide as many top choices as possible and it is strategy-proof. Thus, every participant has no incentive to misrepresent her preferences, as no matter what other subjects do she is always better off by submitting true ranking lists.

MPD treatment:

SID _____

Tentative topic: Smartphone

Please read instructions before submitting your preferences:

The first best topic _____

The second best topic _____

The third best topic _____

We will use the following procedure to allocate topics to students:

Each participant is first randomly assigned a tentative topic. **Your tentative topic is Smartphone.** You will be asked to submit Decision Sheet rankings, which are used to determine mutually beneficial exchanges between two or more participants. The order in which these exchanges are considered is determined by a fair lottery. This means each participant has an equal chance of being the first in line, the second in line, ... , as well as the last in line. The lottery will be run by computer and no one will know the outcome of it before making the decision.

The specific allocation process is explained below.

1. All participants are ordered in a queue based on the order in the lottery.
2. Next, the participant at the top of the queue applies for the topic of his top choice, based on her ranking list.
 - If she applies for her tentative topic, she is assigned to the topic and this assignment is finalized. The participant and her assignment are removed from subsequent allocations. The process continues with the next participant in line.
 - If she applies for a topic which is different from her tentative assignment, the procedure moves as follows:
 - Say applicant Claudia's tentative topic is "topic A" and she is applying for "topic B." Then one of the students who is tentatively assigned topic B has to be chosen. In particular, among all these students we choose the student who is the first one in the queue. Then this student

is moved to the top of the queue directly in front of the requester (Claudia).

3. Whenever the queue is modified, the process continues similarly: the participant at the top of the queue applies for the topic of his top choice, based on her ranking list.

- If she applies for her tentative topic, she is assigned to the topic and this assignment is finalized. The process continues with the next participant in line.

- If she applies for another topic, say “topic C”, then we follow the procedure explained in the example with Claudia: the first participant in the queue who is tentatively assigned topic C is moved to the top of the queue directly in front of the requester.

4. A mutually-beneficial exchange is obtained when a cycle of applications are made in sequence, which benefits all affected participants, e.g., I apply for Stefan’s tentative topic, Stefan applies for your tentative topic, and you apply for my tentative topic. In this case, the exchange is completed and the participants as well as their assignments are removed from subsequent allocations.

5. The process continues until all participants are assigned a topic.

This mechanism takes into account your preferences and preferences of others in order to provide as many top choices as possible and it is strategy proof. Thus every participant has no incentive to misrepresent her preferences, as no matter what other subjects do she is always better off by submitting true ranking lists.