Time Delay and Support for Taxation

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Abstract

People often experience the benefits of taxation with time. We design a novel dynamic market experiment with negative externalities to test the hypothesis that delaying the benefits of taxation can lead to low support for taxes. We consistently find that people are less willing to accept Pigouvian taxes, aimed at reducing negative externalities and restoring market efficiency, when the negative externalities are delayed. While people learn to adopt taxation when the negative externality occurs immediately, the resistance to taxation remains robust over time when the externality is delayed. Our data suggest that time discounting alone is not sufficient to explain the strong negative delay effect as it implies an extremely high discount rate. We provide evidence for alternative explanations and discuss the policy implications of our findings for promoting support for taxation.

JEL codes: D03, D62, D72, H23

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1 INTRODUCTION

Taxation as an incentive-based instrument is a main policy tool to address negative externalities, such as pollution. Taxes can improve social welfare and regulate undesirable activities by increasing the price of the targeted undesirable activity. When the tax amount is equal to the external cost at the optimal level of the targeted activity, as in Pigouvian taxation, the social optimum can be restored if externalities are the only deviations from optimality. Compared with regulatory instruments, taxation is more cost effective because it does not have to specify how agents should behave to comply with the targeted policy. Even though standard welfare economics has proven that incentive-based instruments like taxation are ultimately beneficial, there are often obstacles to implementing taxation due to low public support.

For example, political opinion has recently shifted in favor of the United States taking action on climate change. There is now near unanimity among U.S. economists spanning the political and academic spectrum (Hsu, 2009) in recognizing carbon taxes as the most efficient means of reducing large-scale pollution problems. This would complement European action on carbon emissions through the European Union (EU) Emission Trading Scheme (ETS). Yet support for efficiency-enhancing policies is fragile. Recent opinion polls conducted at Yale University (Leiserowitz *et al.* 2010) reported that only 35% of U.S. citizens support increasing taxes on gasoline. The lack of public support can be an impediment to implementing fiscal interventions to change behavior and improve social welfare[1]. It is thus important to understand the causes of public reactions to different tax proposals.

In this paper, we draw attention to the fact that many consumption or production activities produce negative externalities only after some time. Take Pigouvian taxation as an example. It is aimed at reducing negative externalities such as pollution from the consumption of gasoline. However, consumers obtain the benefit of consuming gasoline right away and only suffer from the cost of pollution in the future and, very often, many years later. This intertemporal structure of the costs and benefits of Pigouvian taxation might explain why citizens are not willing to accept it. Previous research on intertemporal choice has shown that people are less willing to take preventive costly actions now if the losses occur only in the future (Frederick

[1] The lack of public support for taxes can also be an impediment to choose the most cost-effective policy instrument. For example Goulder and Schein (2013) noticed that quantity-controls like Cap-and-Trade systems are often preferred to taxes by policy makers to address the Climate Change problem due to their higher political palatability. Cap-and-Trade systems though can be less cost-effective than taxes if the allowances are allocated for free.

et al., 2002). This literature investigates many important phenomena, such as failing to save or to form healthy habits. Nevertheless, to our knowledge, no studies have investigated whether delaying the benefits of taxes can be a major reason for not supporting them, in particular for Pigouvian taxes.

To understand the role of delays in public support for taxation, we design a novel dynamic market experiment with consumption externalities. We manipulate the timing of the externality and introduce opportunities for the participants to vote whether to introduce a tax on consumption in the market. We first compare voting results when the external costs of consumption happen in the present (No Delay treatment) and when the external costs occur one week later (Delay treatment). In both treatments, participants first purchase products in a market for 10 periods, then are asked to vote whether to introduce a tax on the purchased items in the following trading periods. The voting outcome is applied to the next five periods. Then participants are given another opportunity to vote on taxation for the last five periods.

For our experiment to inform the role of time discounting, we design the parameters such that a lower support for taxation in the Delay treatment compared to the No Delay treatment requires an extremely high one-week discount rate. Interestingly, even in this setting, we observe a series of robust evidences for the negative delay effect. First, while the majority of subjects vote for the tax in the No Delay treatment, support for taxation is significantly lower in the Delay treatment. Secondly, in the No Delay treatment, more people switch from voting against the tax the first time to voting for the tax the second time than those in the Delay treatment. This suggests that people learn to adopt the tax over time when the external cost is immediate, but not when the externality is delayed. Lastly, the tax support rate remains identically low in the Delay condition when the tax is framed as the default and participants can vote not to implement it (Remove treatment). This negative result on the default effect is in contrast with previous findings on the power of default options in the take-up rate of policies such as organ donation or saving (Thaler and Benartzi, 2004; Johnson and Goldstein, 2003). We suggest additional causes for the strong delay effect on tax support in our setting and discuss the implications of our findings for the design of tax policies.

The remainder of the paper is organized as follows. Section 2 discusses the related literature. Section 3 describes the experiment design and procedures followed by the theoretical predictions in Section 4. Section 5 presents the results. Section 6 concludes.

2 RELATED LITERATURE

Experimental research on public support for taxation has identified many important determinants of people's attitudes toward taxes, like the perceived fairness of the instrument (Fehr and Schmidt, 1999), equity considerations (Durante and Putterman, 2007) and trust in the government collecting tax revenues (Rivlin, 1989). Another strand of literature has focused on factors that may increase public support for taxation. The psychology and economics literature suggests that how a tax is framed and communicated affects people's attitudes towards it (Kallbekken *et al.* 2011; Small *et al.* 2006; Sausgruber and Tyran, 2005). There may be an additional burden associated with tax payments compared to economically equivalent payments labeled differently, a phenomenon called tax aversion (McCaffery and Baron, 2006; Kallbekken *et al.*, 2010 and 2011; Blaufus and Möhlmann, 2012).

Little is known about people's attitudes towards taxation in a dynamic setting where the cost and benefit of paying taxes can occur at different times. There is a recently emerging literature on dynamic public goods games where earlier rounds influence the outcome of later ones. Dynamics in these studies are introduced in a public goods game by letting a player's contribution capabilities depend on the past behavior of that player and her group (Battaglini *et al.* 2010; Cadigan *et al.* 2011; Gächter *et al.* 2009; and Gürerk *et al.* 2011). Thus, these studies do not involve real intertemporal choices. This paper differs from this literature in that we shed light on the effect of a *real* time delay of the benefits of cooperation in social dilemmas. In addition, we study a market experiment instead of a public goods game, because we are interested in social attitudes towards taxes on consumption.

One reason why people may be less likely to accept taxes when the benefit occurs in the future is time discounting: individuals value the current costs and benefits more than the future ones (Frederick *et al.*, 2002). However, time discounting may not be the only reason for any potential delay effect. For example, the intertemporal structure of taxation can also increase the complexity of the decision environment and cause a lack of understanding about the workings and effects of taxation thereby leading to the distaste for taxation in dynamic environments[2]. Our

[2] Behavioral research suggests that higher cognitive loads make people more present-biased and more likely to succumb to visceral temptations (Shiv and Fedorikhin, 2002). This bounded rationality hypothesis is consistent with strong present bias. Brown, Chua and Camerer (2009) suggest that lower values of the present bias parameter β may be found in more complex environments. They also show that both private learning (direct experience) and social learning (learning from the experience of others) reduce present bias (increase the value of β). Kallbekken *et al.* (2011) offer evidence that opposition to Pigouvian taxes does not result from a lack of understanding about the

experiment allows us to learn whether any delay effect is simply due to people valuing future payoffs less than current ones.

To the best of our knowledge, our paper provides the first laboratory experiment evidence for the role of real time-delayed tax benefits on tax attitudes. Our experimental design is related to three strands of experimental research: laboratory markets which are predicted to quickly converge towards the equilibrium (Smith, 1962; Smith *et al.* 1982); laboratory markets to examine policies for externalities (Plott, 1983; Tyran and Sausgruber, 2005; Kallbekken *et al.* 2010 and 2011); and experiments using voting to endogenously introduce tax institutions (Sausgruber and Tyran, 2011).

3 EXPERIMENT DESIGN

To address our research question we design a dynamic market experiment with externalities and voting for the introduction of a Pigouvian tax. Subjects earn money by trading a hypothetical consumption good in the market. Each unit traded causes external costs that are equally split by all buyers in each market. Each treatment has two practice trading periods, during which subjects do not make money, and 20 paid trading periods. Participants are not told how many paid trading periods they will participate in during the experiment. The 20 paid trading periods are divided into three stages. The first stage is the first 10 paid periods when participants can trade units of the good in each period. Participants are not given any information about the following two stages. The second stage is the following five periods. At the beginning of this stage (period 11), participants are asked to vote whether to introduce a Pigouvian tax (called tax in the experiment) in the following trading periods. Participants are not given any information about the third stage. The third stage is the last five periods which proceed in the same way as the second stage. In particular, at the beginning of period 16, participants are asked to vote for the same tax again. After the 20th trading period, we and we administer a survey to elicit the subjects' one-week discount rate and to obtain feed-back on the experiment.

To allow the manipulation of the timing of the externality and the benefit of taxation, we tell subjects at the beginning of the experiment that, in addition to the earnings from trading accumulated during the experiment, they will receive an additional $18 cash payment one week after the experiment. To receive this $18 endowment, participants must return to the same lab

purposes of the fiscal instrument. However they use a static experimental environment rather than a more complex dynamic environment.

exactly one week after the end of the experiment but do not have to perform any additional task. To minimize any credibility concerns on the part of subjects in the experiment, at the end of each session each subject is given a "payment certificate" signed by the experimenter indicating the amount to be received, the date, time, and location for the collection of the payment, and the contact details of the experimenter including office address, telephone and email address. In addition, the day before the scheduled pickup day, participants receive a reminder via email. They are also allowed to send someone else, on their behalf, to pick up their second payment. Figure 1 provides the time line of our experiments.

3.1 The market

Since our main interest is treatment difference in voting behavior, we design a simple uniform-price, multi-unit auction (a simplified version of Smith *et al.,* 1982) in which each market consists of four buyers and one automated seller. The auction market we designed to study the support for taxation has also been used by others to investigate people's attitudes towards taxes (Sausgruber and Tyran, 2005 and 2011; Kallbekken *et al.*, 2011). It has three advantages for our purposes. First, it is predicted to quickly converge towards equilibrium (Smith *et al.* 1982). Second, the functioning of the market is relatively easy to explain to participants so that they can quickly understand the functioning of the tax mechanism and its consequences for their payoffs. Third, the use of automated sellers simplifies the analysis and allows us to focus on the consumption side of the market. The demand and supply parameters for all treatments are illustrated in Figure 2.

The buyers are informed about the resale values of the three units they could purchase (which are 160, 110, and 70, respectively) and that the seller's marginal cost will remain constant throughout the experiment. In each trading period $k = 1,\ldots,20,$ each buyer $i = 1,\ldots,4$ can post a bid $b_{ijk} \in [0,\ldots,v_{ij}]$ for each unit $j = 1,\ldots,3$ available in the market, where v_{ij} is the resale value of unit j for buyer i. Sellers have a constant, per-unit production cost c of 40 points. For each unit j, bids from all buyers in each market are ordered from high to low. Sellers will accept all the bids greater than or equal to c and sell the units at the market price p_k, *which equals the lowest accepted bid in trading period k.* Since the market price is determined by the lowest accepted bid, the bids of each buyer affect market prices and buyers experience price fluctuations during the trading phase of the experiment. Each buyer i's gross income earned on each unit j in each trading period k is $\pi_{ijk} = v_{ij} - p_k$. Units that are not traded yield zero earnings.

As Sausgruber and Tyran (2005), the following trading and information rules apply. (i) Buyers must place one bid at a time, starting with the first unit; (ii) buyers cannot resell what they have bought; (iii) each buyer knows only her own resale values and that the unknown seller's marginal production cost remains constant throughout the experiment; (iv) communication among participants is not allowed.

At the end of each trading period each buyer can review information about the outcome of the trading period. The computer shows information about market price, quantity, the buyer's bids, per-capita externalities as described below, and accumulated and per-period earnings. Each buyer can also review the history of results, i.e. the outcome, market price and quantity, units purchased, and payoff of past trading periods (see Appendix A.2 for samples of outcome screens).

Participants are told that trading causes external effects. In particular, a marginal external cost MEC = 60 points is produced by each unit traded so that the per-unit external cost per person is $MEC_i = MEC/n = 15$, where $n=4$ is the total number of buyers in each market. The key feature of our experiment is that we manipulate the time at which the external cost is paid, either immediately on the day of trading or one week later.

- *Immediate externality (No Delay treatment)*

In the No Delay treatment, the external cost of trading is deducted from the subjects' earnings on the day of trading. With the immediate externality, each buyer *i*'s pretax payoff in each trading period *k* is:

$$\pi_{ik} = \sum_j d_{ijk}\pi_{ijk} - \sum_i \sum_j d_{ijk} MEC_{ik} \qquad (1)$$

where $d_{ijk} = 1$ if the j^{th} unit is traded in period *k* and $d_{ijk} = 0$ otherwise.

In our experimental setting, it is easy to calculate that, at the market equilibrium, without any taxation, all buyers purchase three units at a price of 40 (see D_0 in Figure 2). Per-period earnings per buyer are 40 points and social welfare per period is equal to 160 points. However, the socially optimal outcome can be reached if each buyer purchases only two units, which leads to a social welfare of 280 points. With taxation, an amount equal to the marginal external cost $T = MEC=60$ is paid by the buyer on each unit traded and an equal share of the total tax revenues collected in each market in each period is returned to each buyer. The after-tax payoff becomes:

$$\pi_{ik,tax} = \sum_j d_{ijk}\pi_{ijk} - \sum_i \sum_j d_{ijk} MEC_{ik} - \sum_j d_{ijk} T + \frac{\sum_i \sum_j d_{ijk} T}{n} \qquad (2)$$

As shown in Figure 2, the tax shifts the demand curve downwards, from D_0 to D_1[3]. As a consequence, the profit-maximizing strategy for each buyer is to purchase two units, which would produce the socially optimal market quantity of eight units.

- *Delayed externality (Delay treatment and Remove treatment)*

In the Delay and Remove treatments, the external cost of trading is deducted from the $18 endowment subjects receive one week after the day of trading. This condition simulates an environment where activities that are currently beneficial, such as the consumption of gasoline, may cause negative external costs in the future, such as pollution. In naturally occurring environments, the impact of the external costs on welfare can be less salient when they occur only in the future. This can be another reason why people are less willing to accept taxation. As we hypothesize that the delay of the externality leads to less support for Pigouvian taxation even absent the salience effect, we design the experiment such that in all treatments subjects see clearly how the externality affects their payoff (either today or one week later). We expect the delay effect on the support for taxation observed in the experiment to be even more significant in the real world when people cannot see clearly how the externality will influence their future welfare. To keep the salience of the impact of external costs on payoffs symmetrical across treatments, we show each buyer the payoffs of both today and one week later in the outcome screen at the end of each trading period (see Appendix A.2 for computer screen samples).

Building on the theory of stock externalities (Farzin, 1996; Karp, 2005; Kolstad, 2010), trading today causes negative external costs in future periods and external costs accumulate over time. Considering only two time periods, today (trading day), t, and one week later, $t+1$, we define the stock of external costs affecting subject i at time $t+1$ as:

$$s_{i,t+1} = \delta^t \left(\Sigma_i \Sigma_j d_{ij} MEC_{it}\right) \tag{3}$$

where $0 \le \delta \le 1$ is the persistence rate of the external costs generated at time t. When $\delta = 0$, the external costs at time t are not carried over to time $t + 1$. When $\delta = 1$, the external costs at time t are entirely carried over to time $t+1$. Stated differently, δ indicates what fraction of the additional costs from trading at time t will be borne at time $t+1$. In our experiment, $\delta = 1$.

[3] In the experiment, since the external cost of each unit is equally split among all buyers in the market, each buyer pays 15 additional points for each unit he/she purchases. For simplicity, Figure 1 does not include the cost of 15 in the demand curve. Taking into account the additional cost of 15 for each purchased unit will not change the market price and quantity but only the surplus. In particular, the total surplus gained on each of the three units in the experiment is 160-15-40; 110 -15-40 and 70-15-40, respectively.

3.2 Voting

In the Delay and No Delay treatments, at the beginning of period 11 subjects are asked to vote for the introduction of a revenue neutral Pigouvian tax. The tax rate is equal to the marginal external cost $T = MEC=60$ on each unit traded, and an equal share of the total tax revenues collected in each market in each period is returned to each buyer. The revenue recycling mechanism is identical in the Delay and No Delay treatments. That is, even when the external costs are delayed, the tax is paid immediately and the fiscal revenues are returned lump-sum immediately. This ensures that any treatment differences can be attributed to the delayed externality, rather than to issues such as earmarking of the fiscal revenues or uncertainty regarding the future use of the revenues.

Before reaching the ballot, subjects receive an additional set of instructions (see Appendix A.3) with examples explaining the tax mechanism and the consequences of the revenue-neutral taxation on their payoff and are asked to answer a set of questions to make sure they understand the functioning of the tax. In the ballot, all participants simultaneously vote yes or no on the introduction of the tax; abstentions or neutral votes are not possible. Voting is anonymous. The tax is implemented in a market for the following trading periods if at least two participants in the market vote yes. Similar to previous studies (Markussen *et al.*, 2013), each participant is informed about the outcome of the voting in her own market, but not about individual votes. That is, participants are not informed exactly how many voted for the tax.

These same voting rules are applied to the Remove treatment except that subjects are informed at the beginning of periods 11 and 16 that the tax will be introduced, but they can vote no if they want to remove it (see Appendix A.3).

3.3 Questionnaire

As we explain in more detail in Section 4, one reason why the delay of the negative externality may lead to less support for taxation is that people value the current costs and benefits more than the future ones. To explore whether individuals' voting behavior is indeed correlated to time discounting, we conduct a survey to elicit the one-week discount rate of each subject.

To elicit the one-week discount rate we use a simplified version of the basic experimental design for eliciting individual discount rates introduced by Coller and Williams (1999). Subjects are given a set of nine decisions. Each decision consists of choosing between an amount x today and a larger amount $(1+r)x$ in one week, where r is the one-week discount rate. In the experiment, subjects answer a set of questions in which *x* is $20. If, for a given *x* and *r*, a subject prefers the amount *x* today, we can conclude that the subject is willing to forgo an amount *rx* in order to get the money today instead of in a week. Hence, by gradually increasing the interest rate *r* over the nine decisions, we can observe the *r* at which a subject switches from *x* today to *(1+r)x* in one week. Therefore, the switching point serves as a measure of the subject's discount rate.

We use the following values of *r*: 0.00, 0.01, 0.03, 0.05, 0.07, 0.09, 0.10, 0.15, 0.20. At the highest rate, subjects can earn an additional $4 by waiting one week. Note that an *r* of 1% already implies an annual discount rate of 67.76% which is considerably higher than the borrowing interest rate of our subjects. Therefore, an exponential discounter ought to shift to the delayed payment already at this point.

3.4 Experimental procedures

The experiment was conducted at the Pittsburgh Experimental Economics Laboratory (PEEL) between January and March 2013 with a total of 212 students as participants. Each subject could participate in only one of the three treatments: 76 subjects (19 markets) participated in the No Delay treatment; 72 (18 markets) in the Delay treatment, and 64 (16 markets) in the Remove treatment. At the beginning of each session, subjects were randomly assigned to markets and remained in the same market throughout the experiment. Subjects were not informed about the voting stage until they reached the end of trading period 10 and were given a second set of instructions. Each session included 16 or 20 subjects and lasted around 90 minutes. There were a total of 12 sessions with four sessions per treatment for a total of 53 markets. Earnings were expressed in experimental points and exchanged for cash at $1 per 200 points. Participants earned on average $28, including a show-up fee of $5. The pickup rates for the second payment were 97%, 86% and 82% for the No Delay, Delay and Remove treatment, respectively[4]. All sessions were programmed and conducted using the software Z-tree (Fischbacher, 2007).

4 PREDICTIONS

Our first prediction is derived from the analysis of market trading with externalities in the first 10 experimental periods and concerns market quantities in the presence of externalities. Assuming

[4] Differences in the pickup rate across treatments are not statistically significant.

profit maximization, each buyer will trade additional units as far as the additional surplus she gets from one more unit is positive, with no regard for the external costs from trading on other buyers. This implies that the market equilibrium quantity will be larger than the optimal (efficient) level and the market equilibrium payoff will be lower than the efficient level.

Prediction 1 (Overconsumption): *In the trading stage, the Market Quantity in each of the first 10 periods is larger than the optimal level (eight units).*

In period 11, subjects decide in the ballot whether or not to implement a tax against the externality. Our second prediction relates to voting behavior in the presence of immediate externalities.

Condition $\pi_{i,tax} \geq \pi_i$ holds in our setup if subjects trade at market equilibrium before tax (i.e. three units per period) and at efficient equilibrium after tax (i.e. two units per period in our setup) (see Appendix C for details)[5]. From this condition we obtain the following Prediction 2.

Prediction 2 (Voting on tax in the No Delay treatment): *If subjects trade at equilibrium, i.e. three units without tax and two units with tax, profit-maximizing subjects should vote in favor of the tax in the No Delay treatment.*

Next, we discuss the predictions of the voting behavior when the externality is delayed. First, let's consider the impact of time discounting. The discount factor used to compare payoffs in periods t and $t+1$ is $\beta\gamma=\beta/(1+r)$, where r is the (in our setting, weekly) discount rate and $0<\beta\leq 1$. The value β=1 produces the standard model of constant (exponential) discounting, and if $0<\beta<1$ there is quasi-hyperbolic discounting. In the latter case, subjects at time t discount the payoff in $t+1$ at a higher rate than the one used to discount, at time $t+1$, the payoff at time $t+2$. With this simple intertemporal structure of the external costs from consumption, each subject i's pretax payoff in each trading period k becomes[6]:

$$\pi_{it} = \sum_j d_{ijt}\pi_{ijt} - \beta \sum_{\tau=1}^{T-t} \gamma^{\tau} \left(s_{i,t+\tau}\right) \quad (4)$$

where τ is the number of delays from the current time period t and T is the total number of time periods. When there are only two time periods, t and $t+1$, $\tau=1$ and expression (4) becomes

$$\pi_{it} = \sum_j d_{ijt}\pi_{ijt} - \beta\gamma\left(s_{i,t+1}\right) \quad (4.a)$$

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5 Here we assume only one type of subjects, i.e. those who produce externalities are also affected by them. At the optimum, taxation increases not only market payoff but also each subject's payoff. In naturally occurring environments, we may have more heterogeneous types of subjects. For example, some may only bear the external costs but do not produce them and some others may produce externalities but do not share their cost. In these cases, Pigouvian taxation would increase market payoff, but not necessarily each subject's payoff.

6 Since each trading period k has the same set up, to ease notation, henceforth we omit the "k" subscript from payoff functions.

and the after-tax payoff becomes

$$\pi_{it,tax} = \sum_j d_{ijt}\pi_{ijt} - \beta\gamma(s_{i,t+1}) - \sum_j d_{ijt}T + \frac{\sum_i \sum_j d_{ijt}T}{n} \quad (5)$$

Thus, in our experimental setting, for $\beta\gamma = 1$ (no discounting) we should not detect a statistically significant difference between the number of yes votes in the Delay case and in the No Delay case, if subjects trade at equilibrium. For $\beta\gamma < 1$, condition $\pi_{it,tax} \geq \pi_{it}$ holds if $\beta\gamma \geq 0.5$ or $\gamma \geq 0.5/\beta$ (see Appendix C for details). Assuming exponential discounting ($\beta=1$) subjects should vote for the tax for $\gamma \geq 0.5$ *(i.e.,* $r \leq 100\%$*)* and should not vote for the tax otherwise. In other words, if time discounting is the only reason for any delay effect on tax support, we will not observe a different voting behavior in the Delay and No Delay treatments unless subjects have a very high one-week discount rate of at least 100%. Although such a high discount rate does not seem to be possible[7], we conducted a survey to examine whether that is the case in our experiment.

On the other hand, as we discussed before, in addition to time discounting, the intertemporal structure of taxation can increase the complexity of the decision environment and the benefits of taxation become less transparent. Such increased complexity may make individuals less willing to introduce a tax. In this case, even an individual with a low discount rate may vote against taxation. Thus, our design allows us to learn whether treatment difference is due to people valuing future payoffs less than current ones.

Prediction 3 (Delayed externality and voting on tax): *Fewer buyers vote for the tax when the externality of trading is delayed than when it is not.*

5 RESULTS

In the next section we report the market quantity over time in each treatment. Since our interest is the support for taxation, our analysis focuses on the voting behavior. We first report aggregate voting behavior across treatments. Then we examine individual voting behavior to understand the determinants of voting.

5.1 Trading activity

The average market quantity in the first 10 trading periods is around 11 in all treatments and is not statistically significantly different across treatments (Mann-Whitney (MW henceforth) test,

[7] Note that a one-week discount rate of 1% already implies an annual discount rate of 67.76%.

p>0.50).[8] Figure 3 reports the average market quantity over the 20 trading periods by treatment. Consistent with previous studies (Sausgruber and Tyran, 2005; Tyran and Sausgruber, 2005; Kallbekken *et al*. 2011), there was a fast convergence to the market equilibrium quantity of 12 units during the first 10 trading periods. This suggests that on average each subject tries to consume the maximum possible number of units, three, even though this leads to an inefficient outcome. This result supports Prediction 1 and is consistent with the standard economic theory of market behavior in the presence of negative externalities.

After the first ballot, the market quantity drops to the efficient level of eight units in the No Delay treatment. As we discuss next in detail, this is because most groups (89%) adopt Pigouvian taxation in the No Delay treatment. In the Delay and Remove treatments, only 26% and 25% of the groups adopt the tax, respectively. As a result, the market quantity remains relatively high (10 units) although it is lower than in the first 10 periods. The average market quantity in the first 10 trading periods is not statistically significantly different between the No Delay and Delay treatments (11.268 vs. 11.272*, MW test*, *p=0.879*) and between the No Delay and Remove treatments (11.268 vs. 11.394, *MW test*, *p=0.536*). In trading periods 11 to 15 and 16 to 20, the average market quantity is statistically significantly different between the No Delay and the two delay conditions (periods 11-15: 7.737 in No Delay, 10.089 in Delay, and 10.475 in Remove; periods 16-20: 7.579 in No Delay, 9.867 in Delay, and 9.963 in Remove, *MW test, p*<0.05 in all the comparisons between No Delay and the two delay conditions).

The average market price in the first 10 trading periods is 43.142 in the No Delay treatment, 43.228 in the Delay treatment, and 42.319 in the Remove treatment. This average market price is not statistically significantly different across treatments (No Delay vs. Delay, *MW test*, *p = 0.49*; No Delay vs. Remove, *MW test*, *p = 0.56*), but it is statistically significantly different from the equilibrium market price of 40 points (*t-test*, *p <0.01*). In trading periods 11 to 15 and 16 to 20, the average market price is not statistically significantly different across treatments (periods 11-15: 41.484 in No Delay, 41.167 in Delay, and 40.575 in Remove; periods 16-20: 40.642 in No Delay, 40.444 in Delay, and 40.163 in Remove, *MW test*, *p>0.10* in all the comparisons between No Delay and the two Delay conditions).

5.2 Voting on taxation

[8] In all the non-parametric tests, we calculate the average at group level and treat each group as an independent observation.

5.2.1 Aggregate voting behavior

Table 1 shows some descriptive statistics on the number of yes votes per group in the two ballots by treatment. In the first round, support for the tax is significantly lower in the Delay and Remove treatments than in the No Delay treatment (1.166 Delay vs. 2.368 No Delay, *MW test, $p < 0.01$*; 1.062 Remove vs. 2.368 No Delay, *MW test, $p<0.01$*). These results support our Predictions 2 and 3 that the majority of people would support the tax if the external cost occurs immediately, but the delay of the external cost would significantly reduce support for the tax.

Interestingly, the comparison of the voting behavior between the two ballots shows that support for the tax increases in the No Delay treatment (2.368 vs. 3.158, *MW test, $p<0.01$*). In the Delay and Remove treatments, the difference in voting behavior between the two ballots is not significant (1.166 vs. 1.333; 1.062 vs. 1.312, *MW test*, *$p>0.10$*). As a result, in the second round, the rate of group yes votes remains significantly lower in the Delay and Remove treatments than in the No Delay treatment (1.333 vs. 3.158, 1.312 vs. 3.158, *MW test, $p<0.01$*). This suggests that people may learn the benefits of tax over time when the external cost is immediate. However, the delay of the external cost may diminish such a learning effect. To provide statistical evidence for the treatment effect, we calculate the difference in yes votes between the second and the first ballot for each group in each treatment. Such a difference is significantly higher in the No Delay treatment than in the Delay (0.789 vs. 0.167, *MW test*, *$p = 0.034$*). Such a difference is also higher in the No Delay compared to the Remove treatment, although it is not statistically significant (0.789 vs. 0.167, *MW test*, *$p =0.116$*).

In the Remove treatment, we announce at the beginning of period 11 that a revenue-neutral tax policy is introduced and we explain how the policy will affect trading and earnings. Subjects are then given the option of removing the tax policy by voting yes or no in a referendum. We find no significant difference between voting behavior in the Delay and Remove treatments. Making taxation the default option does not seem to reduce the resistance to taxation when the benefit of taxation is delayed. It is worth noting that unlike previous studies on the default effect (Abadie and Gay, 2006; Choi *et al*., 2004; Levav *et al.* 2010, to cite a few), in our experiment, the "default" of tax position (i.e., implementing the tax) actually consists of making a change to the situation that subjects have been experiencing (i.e., no tax). One interpretation that deserves further investigation is that people are much less likely to uphold the suggested default option if it implies a change from the existing situation.

5.2.2 Individual difference in voting behavior

We mention in the predictions section that a profit-maximizing subject should vote for tax in the No Delay treatment. In the two delayed treatments, for a discount factor $\beta\gamma \geq 0.5$, profit-maximizing subjects should vote in favor of the tax (see the prediction section). To see if profit maximizing subjects are more likely to vote for the tax, we examine the correlation between purchasing behavior and voting behavior. It is reasonable to assume that the more units one purchases, especially in earlier trading periods, the more profit-driven one is or the better one is at pursuing profit. Since purchasing behavior in later periods is more likely to be influenced by other buyers' behavior, we use the amount a buyer purchased in the first five trading periods as an indication of whether the buyer is profit-maximizing.[9] In Table 2, we report results of a random group effects probit regression analysis of voting behavior ($Vote_i$=1 if vote yes; = 0 if vote no) for the first ballot.

The independent variables include: two treatment dummies (Delay, Remove), the average number of units bought by a buyer in the first five trading periods ($\overline{FQ_i}$), the average number of units bought by the other three buyers in the same market in the first five trading periods ($\overline{OFQ_i}$), the number of units bought by a buyer in the second five trading periods ($\overline{SQ_i}$), and the average number of units bought by the other three buyers in the same market in the second five trading periods ($\overline{OSQ_i}$). The random effects capture group heterogeneity. We include the other three buyers' trading behavior to control the group effect, as one's voting behavior in later periods may be influenced not only by his own preference for profit-maximization, but also by his group members' trading behavior. The results are shown in Table 2.[10]

The significance of the negative coefficients of Delay and Remove argues again for a significant negative effect of the delay of the externality. In addition, the regression result shows that the coefficient of $\overline{FQ_i}$ is significant. This suggests that those buyers who tend to purchase more units in the market are more likely to vote for the tax.

We next examine how people's attitudes towards taxation may change over time and how the delay affects such changes. We have reported evidence of aggregate voting behavior

[9] It is possible that even a profit-driven participant may fail to purchase the maximum units in the first one or two periods as it might take practice to learn what the profit-maximizing strategy is. Thus we use the average purchasing behavior over the first five periods. We also tried other cutoffs, i.e., the average purchasing behavior in the first three or four periods. The results are robust to other cutoffs. These additional results are available from the authors upon request.

[10] We allowed for treatment differences in "$\overline{FQ_i}$." As there is no treatment difference, we pooled the three variables together.

suggesting that people may learn to support the tax in the No Delay treatment, but not when the benefit of taxation is delayed. We next compare individual voting behavior in each ballot. Figure 4 reports the distribution of all possible combinations of voting behavior in the two ballots by treatment. "YesNo" is the percent of subjects in each treatment who switch from voting yes the first time to voting no the second time; "NoYes" is the percent of subjects who switched from voting no the first time to voting yes the second time; "YesYes" is the percent of subjects who voted yes both times and "NoNo" that of subjects who voted no both times.

Figure 4 suggests that, compared with the two delay conditions, those who voted no the first time are more likely to switch to yes in the second ballot in the No Delay treatment. On the other hand, those who voted yes the first time are more likely to continue to vote yes in the second ballot in the No Delay treatment. To provide statistical evidence for these treatment differences, we calculate for each group in each treatment the probability of switching to yes in the second ballot as the ratio of the total number of NoYes to the total number of no votes in the first ballot. We find a statistically significant difference in the probability of switching from no to yes between the No Delay and Delay treatments (63.7% vs. 21.5%, *MW test*, $p<0.01$) and between the No Delay and Remove treatments (63.7% vs. 19.2%, *MW test*, $p<0.01$). We cannot reject the null hypothesis that subjects are equally likely to switch from no to yes in the Delay and Remove conditions (21.5% vs. 19.3%, *MW test*, $p>0.50$).

Similarly, among those who voted yes the first time, we compare the probability of buyers to switch from yes to no. This probability is much higher in the Delay and Remove treatments than in the No Delay treatment, although only the difference between Delay and No Delay is significant. (4.9% No Delay vs. 30.4% Delay, *MW test*, $p=0.04$; 4.9% No Delay vs. 13.6% Remove, *MW test*, $p=0.27$).

These results suggest that, compared with the conditions where the benefits of taxation are delayed, people are not only more likely to vote for taxation but also more likely to switch to support taxation even when they did not at the beginning if the benefits are immediate. Moreover, in the Delay conditions, even the minorities who initially supported taxation may change to go against the tax over time.

One possible explanation is that among those who voted no the first time, more subjects traded with tax in place between period 11 and 15 in the No Delay treatment than in the Delay and Remove treatments (26.32% vs. 11.11% and 9.38%, Z-tests, $p=0.018$ and $p=0.010$, respectively). If experiencing the tax helps subjects to learn its beneficial effect, we will observe that people who voted no the first time are more likely to switch to vote yes the second time in the No Delay treatment than in the two delay conditions. To further explore the role of tax experience on individual voting decisions we look at whether experiencing the tax affects the probability of voting yes the second time in a random effects probit regression where the random effects capture group heterogeneity. The explanatory variable is whether the tax is implemented in the buyer's market between periods 11 and 15 as a result of the first ballot. [11] We allow different coefficients for each treatment. We conduct this regression analysis separately for those who voted yes the first time and those who voted no the first time. Results are shown in Table 3.

Regression (1) show that among those who voted no the first time, tax experience has a positive and very strong effect on the probability of voting yes the second time but only in the No Delay treatment (β_1). On the other hand, regression (2) suggests that for those who voted yes the first time, tax experience actually has a marginally significant negative effect in the two delay conditions (β_2 and β_3) and we do not observe such a negative effect in the No Delay treatment (β_1 is positive but not significant). The negative tax experience effect in the two delay conditions can be explained by the fact that buyers in these two treatments will see that *current* earnings are actually lower when the tax is introduced although the deduction amount from the next week's earnings is smaller. If buyers focus on the current earnings, they will switch to vote no in the second ballot. In both regressions, the tax experience effect in No Delay is jointly significantly different than the other two treatments (β_1 is jointly significantly different than β_2 and β_3, chi-square tests, $p<0.05$).

These results provide insights to help understand the delay effect on how people's attitude toward tax changes over time as observed in Figure 4. First, when the benefit of taxation is delayed, people are less likely to experience the tax due to the lower initial support for taxation. Secondly, unlike the No Delay case, experiencing the tax in a delay condition has no

[11] The regression models we analyze here potentially suffer from endogeneity problems given tax experience to some extent is determined by a buyer's own voting behavior. Although it is beyond the scope of this study, it would be valuable to conduct further studies to learn how delay interacts with the effect of tax experience on the tax attitude by exogenously manipulating tax experience (e.g. randomly assigned by a computer). Nevertheless, we tested the robustness of our findings of the tax experience effect by estimating a bivariate probit model in which tax experience is instrumented with the number of Yes votes in the first ballot of the other three buyers in the same market. Given subjects were not informed exactly how many buyers voted yes or no in the first ballot, it is reasonable to assume that the voting behavior in the second ballot is not correlated with this instrumental variable especially for those who voted No the first time. Since we have only one instrumental variable, we run the regressions for each treatment separately (see Appendix D). The regression results are consistent with Table 3.

impact on those who voted no the first time and, even worse, it can have a negative impact on those who voted yes the first time.

Our finding of the positive tax experience effect in the No Delay treatment is consistent with previous research showing that market experience eliminates market anomalies (Smith *et al.* 1988). It is also consistent with similar market experiments with externalities (Tyran and Sausgruber, 2005) showing that roughly two-thirds of subjects who experienced the beneficial effects of a tax policy innovation vote to uphold the innovation in later periods. Interestingly, a new finding in our study is that when the benefit of taxation is delayed, experiencing taxation does not lead one to be more likely to support it and might even have a negative impact on those who support it initially.

5.3 Time Discounting and Support for Taxation

We have elaborated that for time discounting alone to predict any negative effect of delay on support for taxation in our setup, subjects should display a very high one-week discount rate. Assuming exponential discounting ($\beta=1$) subjects should vote for the tax for $r\leq 100\%$ and should not vote for the tax for $r\geq 100\%$. As described in Section 3.3, we elicited subjects' one-week discount rate (the one-week discount rate at which subjects switch from early to late cash payment). In total, 22 subjects (31%) in the Delay and 11 (17%) subjects in the Remove treatment switch at a one-week discount rate of 1%, which is the choice a rational exponential discounter is expected to select. Most subjects (66 out of 72 in the Delay and 53 out of 64 in the Remove treatment) display a one-week discount rate in the range 1% - 20% (on average, $r=7.5\%$ in Delay and 9.3% in Remove). Overall, the average one-week discount rate is $r=9.4\%$ in the Delay treatment and 12.1% in the Remove treatment[12]. The discount rate pattern is consistent with similar studies measuring short-term discount rates using monetary rewards. For example, Reuben, Sapienza and Zingales (2010) found an average one-week discount rate of 5.46% with 33% of subjects switching at a one-week discount rate of 1%.

Thus, the low support for the tax in the two delay conditions does not seem to be explained by exponential discounting (Pearson correlation coefficient between yes in the first ballot and discount rate is -0.087, $p=0.517$(Delay); -0.022, $p=0.467$ (Remove); between yes in the second ballot and discount rate: -0.174, $p=0.143$ (Delay); -0.145, $p= 0.475$ (Remove))[13].

[12] The average one-week discount rate in the No Delay treatment is 10%.

[13] We also ran the regressions in Table 2 and 3 by adding *r* as an explanatory variable, and it was not significant.

5.4 Insights from the questionnaire

To gain additional understanding of the voting behavior, we performed content analysis (Krippendorff, 2004) on the messages written by the subjects at the end of the experiment, as answers to a set of questions related to their voting behavior.

Specifically, subjects were asked to answer the following questions: (1) "How did you decide to vote in favor or against the tax?"; (2) "Was your second vote different from your first vote during the experiment?" (answer: Yes/No); (3) "If Yes, why did you change your mind?". We recruited 12 evaluators from the PEEL subjects pool to participate in the content analysis of answers to questions (1) and (3). To reduce the amount of work for each evaluator so that he/she paid sufficient attention to the task in the one-hour session, for each treatment, we randomly divided all the messages into two sets, each of which were evaluated by two different evaluators. There were six sets of messages (two for each of the three treatments). Before receiving any messages, evaluators were given detailed written instructions to become acquainted with the rules of the experiment from which the messages were generated. Each evaluator was instructed to evaluate every message and was told she would earn \$15 (including a \$5 show-up fee) for doing so. Following Houser and Xiao (2011), evaluators also knew that at the end of the session two messages would be randomly chosen to test whether the code matched that of the other evaluator who received the same set of messages. If they matched, the evaluators would receive another \$2 for those two messages. (See Appendix B.1 for instructions on the content analysis.)

The evaluators coded the messages from the first question into five categories and the messages from the second question into six categories (see Appendix B.1). The inter-rater reliability is satisfactory, with the Cohen's $k > 0.70$ for each pair of messages set in each treatment.

In each treatment, compared with those who voted yes the first time, we find that more subjects who voted no the first time found it difficult to understand the functioning of the new institution. In particular, in the No Delay treatment, 30.4% of those who voted no and only 10.3% of those who voted yes the first time indicate difficulty in understanding (Z-test, *p=0.04*).[14] These percentages are 29.3% vs. 10.6% in the Delay (Z-test, *p=0.11*) and 29.3% vs.

[14] As we detailed in Appendix B.2, we compare only the messages that coders agree on in at least one category. It turns out no message has more than one category that is agreed on by both coders. The same is true for Delay and the Remove treatments.

7.1% in the Remove treatment (Z-test, *p=0.09*). The details of the results are reported in Appendix B.2. The results from content analysis of the survey data suggest that complexity can contribute to the distaste for introducing taxation. The intertemporal structure of the costs and benefits of taxation in the Delay and Remove treatments makes the experimental environment more complex, because making good decisions in these environments requires subjects to take into account that the benefits of taxation will only occur in the future. In our experiment, in the No Delay treatment 7 out of 62 messages are from those buyers who voted no and indicated complexity as one reason for their voting decisions. This proportion is higher in the Delay and Remove treatments: 12 out of 60 in Delay and 12 out of 55 in Remove. The difference is only marginally significant though (*MW test*, two-tailed *p<0.10*).

6 CONCLUSIONS

Incentive-based instruments like taxes are generally suggested as the main policy tool to address externalities and, more generally, to change behavior since they modify the relative prices that agents face. They do so in a cost-effective way, meaning that the optimum is reached at the minimum cost, because each agent can adapt to the fiscal measure according to her preferences and constraints. Yet, they are very difficult to implement because public support for these instruments is extremely low. In this paper, we provide strong experimental evidence of a negative relationship between time delay of the negative externality and support for taxation. More specifically, we show that when the negative external effects of consumption are delayed, people are less willing to accept the introduction of Pigouvian taxes as incentives to change consumption behavior. The relationship between support for taxation and the temporal structure of the costs and benefits of taxation is robust even when we frame taxation as the default option. Interestingly, we find that the majority of those who voted against the tax switch to supporting the tax after having experienced the tax institution. But such a switch does not occur when there is a delay in the negative externality. Our data suggests experiencing the tax institution can promote more willingness to accept it when its benefits are immediate, but not when they are delayed.

We demonstrate that exponential time discounting alone is not sufficient to explain the delay effect on the attitude toward tax. Answers to the survey questions suggest distaste for taxation is correlated with the perceived complexity of the environment. The intertemporal structure of the decision environment might increase complexity and lead people to be less likely to choose to introduce a new institution. This is consistent with previous literature on dynamic choice models showing that environments in which current choices influence future constraints or utilities are computationally difficult, and the resulting bounded rationality is an important explanation of seemingly irrational behaviors like undersaving or overconsumption (Brown, Chua and Camerer, 2009).

One practical implication of our findings is that taxes aimed at reducing future externalities should be initially set at a rate lower than the optimal one implied by static analysis and then increase over time to the target rate. Our findings also suggest that, to obtain public support for taxation, additional efforts are needed to help people understand the benefits of the new institution and the consequences of their voting decisions. Policy strategies framing the future external costs as more immediate and salient could be useful in decreasing distaste for taxation. For example, recent advances in the neurosciences suggest that episodic tags presented during a delay discounting procedure reduce impulsive choice through an induction of episodic imagery and support the dynamic adjustments that enable us to make choices that maximize future payoffs. In a set of intertemporal choice studies Peters and Büchel (2010) found that increasing the tangibility of the future, by accompanying intertemporal choices with a reference to an event the subjects had planned for that future date (e.g., "vacationing in Paris") significantly reduced discount rates.

Manipulating the salience of the external costs could also play a role. It is worth noting that in our experiment, we design the experiment such that the salience of the negative externality is symmetric across treatments. In particular, in all the three treatments, buyers see the payoffs of both today and one week later in the outcome screen at the end of each trading period. The delay effect on the support for taxation is likely to be even more significant in the real world when people cannot see as clearly as in the experiment how the externality will influence their future welfare. It would be useful to conduct a future study to investigate whether increasing the salience of the negative externality can promote support for taxation in the delay condition.

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Figure 1: Timeline of the experiment

Timeline

First day	Period 1~10	In each period: Each buyer can trade up to three units of the good.
	At the begining of period 11	First ballot (without knowing about the second ballot) ↓ Each buyer votes Yes or No for the tax. ↓ Eacy buyer is informed of whether the tax will be implemented in the subsequent periods.
	Period 11-15	In each period: Each buyer trades on the market with or without tax depending on the voting outcome.
	At the begining of period 16	Second ballot Same as the first ballot.
	Period 15-20	In each period: Each buyer trades on the market with or without tax depending on the voting outcome.
One week later		Participants pick up additional earnings: • $18 in No Delay treatment • $18 minus the produced total external cost in the Delay and Remove treatments.

Figure 2: Induced Market Demand and Supply

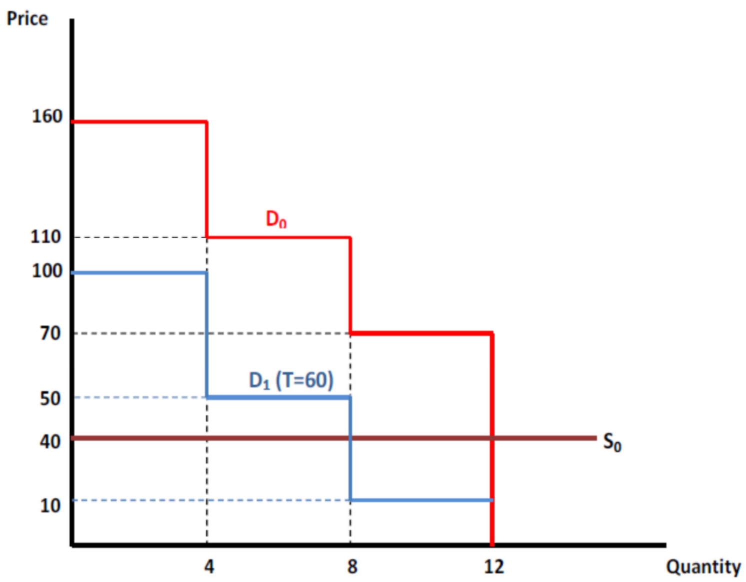


Figure 3: Average Market Quantity by Treatment

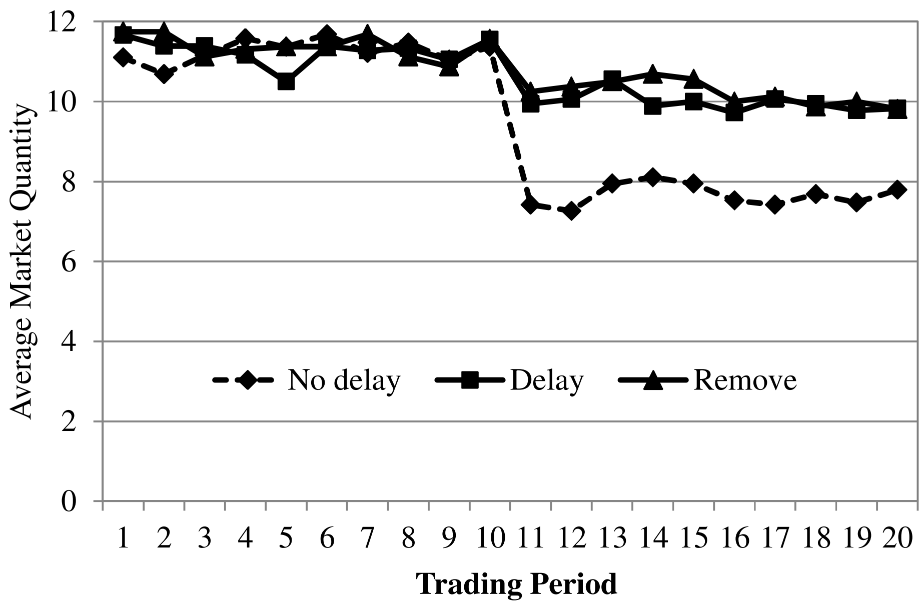


Figure 4: Distribution of the Switches of Voting in the Two Ballots

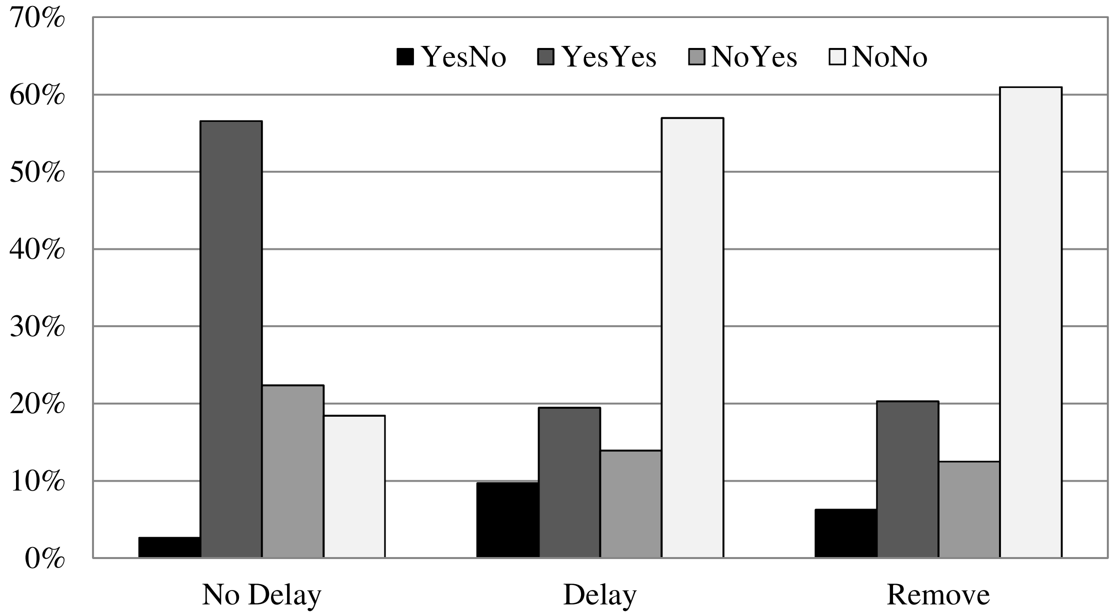


Table 1: Summary Statistics on Group Voting by Treatment

	Mean	Median	s.e.	Min	Max
No Delay					
First yes	2.368	3	0.256	0	4
Second yes	3.158	4	0.257	0	4
Delay					
First yes	1.166	1	0.232	0	4
Second yes	1.333	1	0.198	0	3
Remove					
First yes	1.062	1	0.249	0	3
Second yes	1.312	1	0.198	0	3

Table 2: Random group effects probit regression analysis of voting behavior in the first ballot

Dependent variable: $Vote_i = 1$ if buyer i voted yes in the first ballot

	Coef.	**Std. Err.**
$\overline{FQ_i}$	1.04***	0.39
$\overline{OFQ_i}$	0.34*	0.21
$\overline{SQ_i}$	-0.46	0.32
$\overline{OSQ_i}$	-0. 81	0.18
Delay	-0.85***	0.23
Remove	-1.06***	0.25
Constant	-4.88**	2.25
Wald chi^2(6)	26.11	
# of obs.	212	

Note: *, **,*** indicate statistical significance at 10%, 5% and 1%, respectively.

$\overline{FQ_i}$: the average number of units bought by a buyer i in the first five trading periods.
$\overline{OFQ_i}$: the average number of units bought by the other three buyers in a buyer i's market in the first five trading periods.
$\overline{SQ_i}$: the number of units bought by a buyer i in the second five trading periods.
$\overline{OSQ_i}$: the average number of units bought by the other three buyers in a buyer i's market in the second five trading periods.
Delay: =1 if in Delay treatment; =0, otherwise.
Remove: =1 if in Remove treatment; =0 , otherwise.

Table 3: Random Effects Probit regression of voting behavior in the second ballot

	Dependent variable: $Vote_i$ = 1 if buyer i voted Yes in the second ballot			
	Include only those who voted No in the first ballot		Include only those who voted Yes in the first ballot	
	Coef.	**Std. Err.**	**Coef.**	**Std. Err.**
β_1: NDtaxexperience	1.444***	0.331	0.509	0.515
β_2: Dtaxexperience	0.601	0.476	-0.976*	0.538
β_3: Rtaxexperience	-0.048	0.627	-0.933*	0.564
Constant	-0.920***	0.150	1.187***	0.396
Wald Chi^2(3)	19.82		12.49	
#obs	129		83	

Note: * and** and *** indicate statistical significance at 10%, 5 % and 1 % level, respectively.

NDtaxexperience = 1 if a buyer *i* in the No Delay treatment traded with tax between period 11 and 15; =0, otherwise.
Dtaxexperience = 1 if a buyer *i* in the Delay treatment traded with tax between period 11 and 15; =0, otherwise.
Rtaxexperience = 1 if a buyer *i* in the Remove treatment traded with tax between period 11 and 15; =0, otherwise.

APPENDIX

A. Instructions

A. 1 Instructions on the auction

(All the three treatments)

- ***General***

Thank you for coming! You've earned $5 for participating, and the instructions explain how you can make decisions and earn more money which will be paid to you in cash.

This is an experiment in the economics of market decision making. In this experiment we are going to simulate a market in which each participant will be a buyer in a sequence of trading periods.

There should be no talking at any time during this experiment. If you have a question, please raise your hand, and an experimenter will assist you.

During the experiment your earnings will be calculated in experimental points. Experimental points will be converted in Dollars at the following exchange rate:

200 experimental points = 1$

At the end of today's experiment you will receive, in cash, the earnings you make today. In addition, you will receive a payment certificate to pick up your $5 participation bonus and an additional cash payment of $18 the same day next week.

For example, if today is Monday, you will receive the $5 participation bonus and the additional $18 cash payment next Monday. To pick up these amounts, you need to come back to the same lab between 3:30 and 4:00pm the same day next week (if you cannot make it at this time please send an email to [experimenter's email address here] to schedule another time <u>on the same day</u> or you can send someone else to pick up your cash payment <u>on the same day</u>). You do not need to participate in any decision task next week to receive the additional $18 payment.

(Delay and Remove only)

However, as we describe below, you may lose some of this $18 depending on the decisions you and the other 3 buyers in your market make today. Therefore, the final amount of the additional cash payment you will pick up next week will depend on the decisions you and the other 3 buyers in your market make in today's experiment.

(All the three treatments)

In today's experiment, you will first participate in two practice trading periods followed by a number of paid trading periods. In the practice trading periods you do not earn money, but you should take these periods seriously since you will gain valuable experience for the paid trading periods.

- ***Specific instructions to buyers***

  In this experiment each participant is a buyer. Each buyer is randomly assigned to a group of 4 buyers – a market – and remains in the same market with the same buyers throughout the experiment. What is happening in other markets is irrelevant for your own market and hence for your own earnings. During each trading period each buyer can buy units (up to 3 units) of a hypothetical consumption good from an automated (computerized) seller.

Resale value of a unit. At the beginning of each trading period, you will be given three separate resale values for each of the three units of the good you can purchase. These are your privately known resale values. You can think of the resale value of a unit as the potential earnings you can make out of that unit. Your resale values will remain the same in each period during the experiment.

Bid. As a buyer, you can submit a "bid" to buy a unit from the seller during a trading period. A "bid" is the amount you are willing to pay for that unit of the good. You must submit one "bid" for each of the three units. (If you do not want to purchase a unit, you may simply submit a bid "0".) Your bids have to follow the following two rules: 1) "Trade at no loss": your bid for each unit cannot be above your resale value for that unit; 2) Your bid for the third (second) unit cannot be above your bid for the second (first) unit.

- ***How the market works***

At the beginning of each trading period each buyer submits bids for each unit offered in the market. At the end of each trading period, all submitted bids are collected and ranked from high to low. If two or more bids are equal, ranks will be randomly assigned by the computer.

1. ***How the Market Price is determined***

The automated seller has a production cost unknown to all buyers. The production cost does not change during the experiment. The seller never trades at a loss, therefore it will not accept bids below its production cost. The seller will accept, among all bids from all buyers in the market, the lowest bid above the production cost. This will be the per-unit **Market Price**. Bids that are below the production cost will be rejected and buyers who have submitted those bids won't buy any units (i.e. buyers will neither pay for those units they placed a bid nor gain any resale value from those units).

The market price can be different in each period because it depends on the bids that are submitted in each period.

2. *How the Market Quantity is determined*

Buyers will purchase a unit when their bid is greater than or equal to the market price. The **Market Quantity** is the total number of units purchased by the 4 buyers in one market in one period at the market price.

Example: Suppose, in one market and in one trading period, the automated seller's production cost is 70. And suppose the automated seller collects the following bids from the 4 buyers.

	Buyer 1	Buyer 2	Buyer 3	Buyer 4
Bid Unit 1	**135**	**135**	**140**	**145**
Bid Unit 2	**85**	**90**	**94**	**85**
Bid Unit 3	**80**	0	**80**	40

The bids are ranked from high to low as follows: 145, 140, 135, 135, 94, 90, 85, 85, 80, 80, 40, 0. In this case, the **Market Price is 80 (**the lowest bid above the production cost of 70). All 10, and only the 10 units for which the bids were equal or above the market price of 80 will be purchased by the buyers who submitted the corresponding bids. These 10 sold units are bolded in the table. Each of these 10 units will be exchanged at 80. The market quantity in this case is 10. The number of sold units is determined by the number of submitted bids above or equal to the market price. Units for which the submitted bids are below the market price will not be sold.

Please note: The information on values and production costs of a unit is private. Buyers do not know the bids of other buyers, nor do they know the per-unit production cost for the seller.

(No Delay treatment)

3. *Additional Costs from Trading*

Each unit traded in the market (i.e. each unit sold) causes an additional cost of 60 points that will be equally split by the 4 buyers in the market. This means that each of the 4 buyers in the market has to pay an additional cost of 60/4=15 points. **Note** <u>that you will bear a share of the additional costs even if you do not buy any units yourself.</u>

Using the example above where the market quantity is 10 units, in this case, each buyer incurs an additional cost of (60/4)*10=150 points=$0.75.

4. *How your earnings today in each trading period are calculated*

Your Final earnings in one trading period = Gross earnings in the trading period - **Additional Costs** per person in the trading period, where

Gross earnings in one trading period = (Resale value - Market price) of each unit purchased

In the example above Buyer 4 buys two units. Her resale value for Unit 1 is 200, her resale value for Unit 2 is 140 and her resale value for Unit 3 is 100. The market price is 80. Her Gross earnings in this period are = 200 (resale value of Unit 1) + 140 (resale value of Unit 2) – 2*80 (market price) = 340 – 160 = 180.

Since the market quantity is 10, the additional costs per person are (60/4)*10 = 150. Her **Final earnings** in this period =180 (Gross earnings) – 150 (Additional costs per person) = 30.

As you can see, in this case, even though Buyer 4's resale value for Unit 3 is 100, which is higher than the market price 80, Buyer 4 did not purchase the unit because her bid for Unit 3 (40) is lower than the market price (80).

Your total Final earnings for today are the sum of your Final earnings in each trading period over all the paid trading periods.

5. ***How your earnings next week are calculated***

Each participant will receive $18 next week. You do not need to participate in any decision task next week to receive the cash payment for the next week. You just need to pick it up in the lab between 3:30 and 4:00pm on the same day next week.

(Delay and Remove treatments)

3. Additional Costs from Trading

Each unit traded in the market (i.e. each unit sold) causes an additional cost of 60 points that will be equally split by the 4 buyers in the market. This means that each of the 4 buyers in the market has to pay an additional cost of 60/4=15 points. **Note** <u>that you will bear a share of the additional costs even if you do not buy any units yourself.</u>

<u>These additional costs will not affect your earnings today but will be deducted from the $18 cash payment you will receive next week.</u>

Using the example above where the market quantity is 10 units, in this case, each buyer incurs an additional cost of (60/4)*10=150 points=$0.75. This $0.75 additional cost will be deducted from the $18 cash payment each buyer will receive next week.

4. How your earnings today in each trading period are calculated

Your Final earnings in one trading period = (Resale value - Market price) of each unit purchased

In the example above Buyer 4 buys two units. Her resale value for Unit 1 is 200, her resale value for Unit 2 is 140 and her resale value for Unit 3 is 100. The market price is 80. Her **Final earnings** in this period are = 200 (resale value of Unit 1) + 140 (resale value of Unit 2) – 2*80 (market price) = 340 – 160 = 180.

As you can see, in this case, even though Buyer 4's resale value for Unit 3 is 100, which is higher than the market price 80, Buyer 4 did not purchase the unit because her bid for Unit 3 (40) is lower than the market price (80).

Your total Final earnings for today are the sum of your Final earnings in each trading period over all the paid trading periods.

5. How your earnings next week are calculated

<u>The additional costs imposed on each buyer in each period will be deducted from the $18 cash payment each buyer will receive next week.</u>

In the example above, since the market quantity is 10 the additional costs per person are (60/4)*10 = 150 points=$0.75. Thus, the $18 cash payment to be received by Buyer 4 in the next week will be deducted by $0.75.

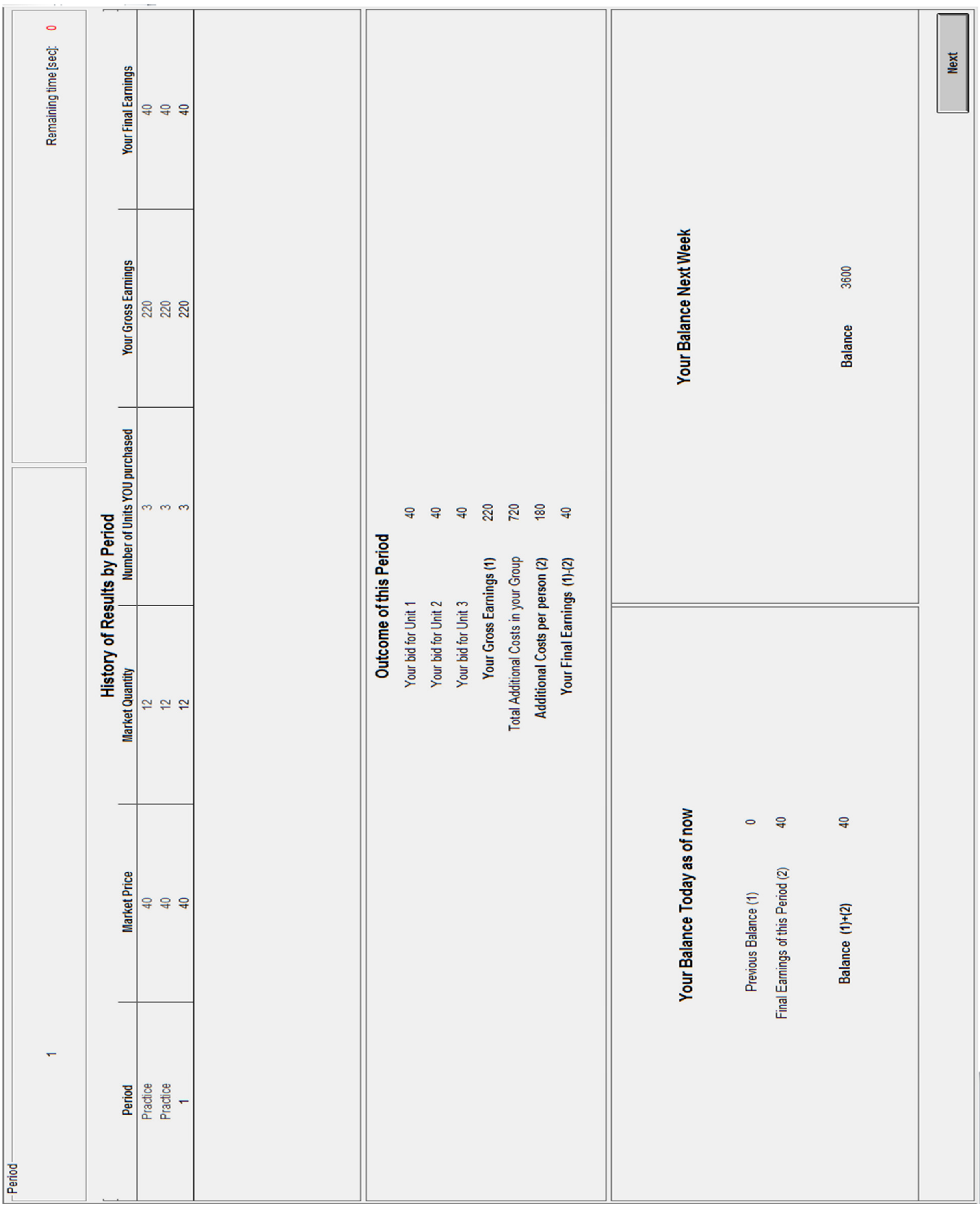
So, the final **cash payment each buyer will receive next week = $18 - the sum of the Additional Cost per person in each period today**.

Therefore, the final amount of the cash payment you will pick up next week will depend on the decisions you and the other 3 buyers in your market make today.

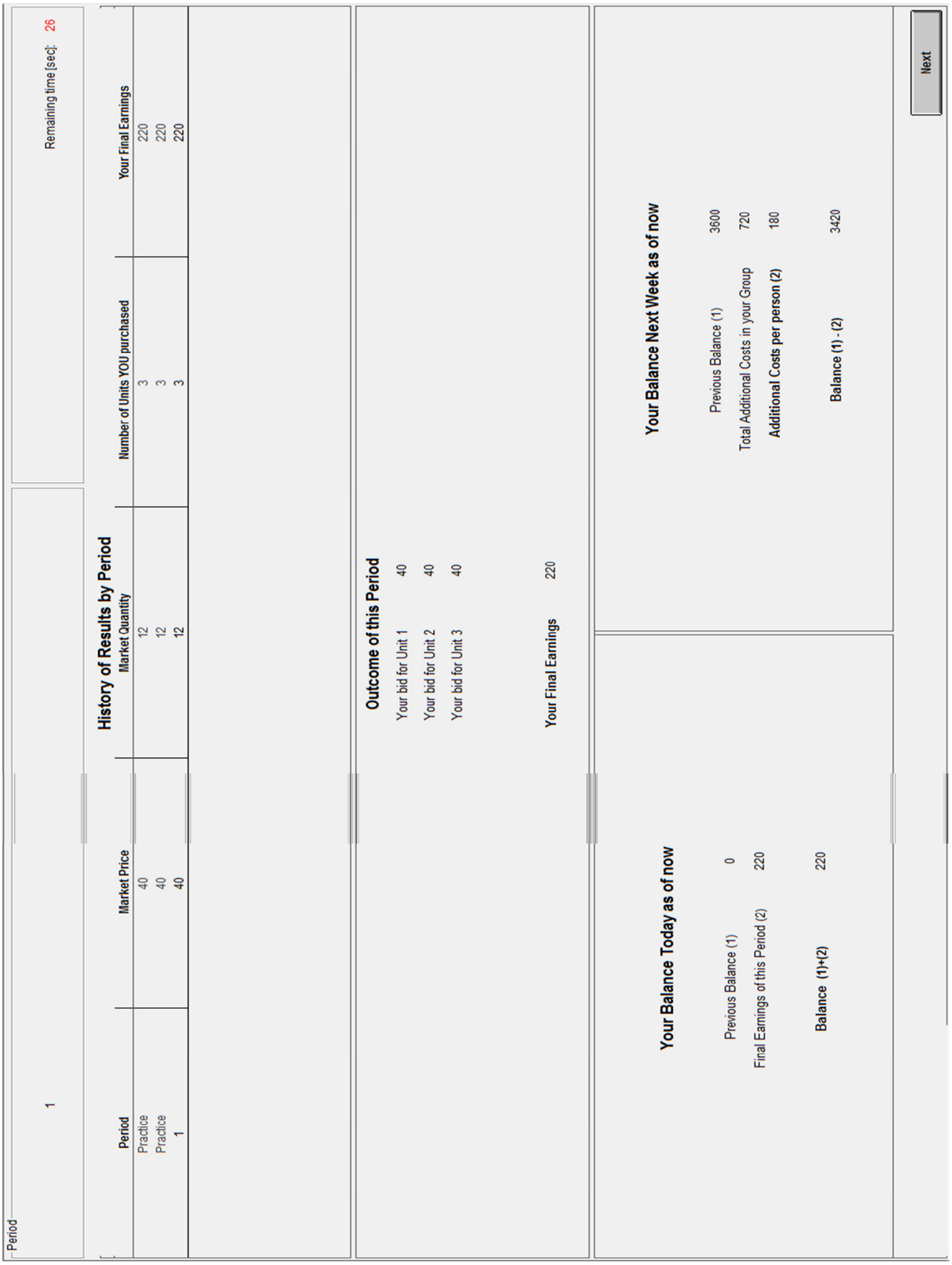
You do not need to participate in any decision task next week to receive the cash payment for the next week. You just need to pick it up in the lab between 3:30 and 4:00pm on the same day next week.

A. 2 Sample Outcome Screen

No Delay Treatment



Delay and Remove treatments



A. 3 Voting Instructions

(No Delay and Delay treatments)

You and the other three participants in your market will now vote whether to introduce a tax of 60 points on each purchased unit of the good. If at least two out of four buyers in each market vote “Yes”, the tax is accepted and the following changes are implemented for the following trading periods: 1) a tax of 60 points will be deducted from your gross earnings for each unit you purchase; 2) at the end of each period, an equal share (one-fourth) of the total tax revenues collected from all units traded in your market will be returned to each buyer. All the other rules described in the instructions for the first 10 trading periods remain the same. In particular, seller’s production cost and each buyer’s resale values of each unit remain the same as the previous 10 periods.

Example

<u>Suppose the tax of 60 points per unit is accepted as the outcome of the voting in your market</u>.

(Remove treatment)

A tax of 60 points on each purchased unit of the good is now introduced and the following changes are implemented for the following trading periods: 1) a tax of 60 points will be deducted from your final earnings for each unit you purchase; 2) at the end of each period, an equal share (one-fourth) of the total tax revenues collected from all units traded in your market will be returned to each buyer. All the other rules described in the instructions for the first 10 trading periods remain the same. In particular, seller’s production cost and each buyer’s resale value of each unit remain the same as the previous 10 periods.

Example

(All three treatments)

To illustrate how the tax would affect the outcome of the market and your earnings we use the same example from the instructions for the first 10 trading periods. In that example, when a buyer obtains one unit of the good, she will receive her resale value but now she will also have to pay the tax of 60 points. Consider Buyer 4. Buyer 4’s resale value for Unit 1 is 200, her resale value for Unit 2 is 140 and her resale value for Unit 3 is 100. Since Buyer 4 will also have to pay the tax of 60 points on each purchased unit, the maximum she could pay to the seller and still make a gain is (200 – 60) = 140 for Unit 1, (140-60) for Unit 2 and (100 – 60) for Unit 3.

Consider again the example in which the seller collects the following bids from the 4 buyers. Let’s assume each buyer bids 60 less than before for each unit due to the tax he/she has to pay for each purchased unit.

	Buyer 1	Buyer 2	Buyer 3	Buyer 4
Bid Unit 1	**(135 - 60) = 75**	**(135 - 60) = 75**	**(140 - 60) = 80**	**(145 - 60) = 85**
Bid Unit 2	(85-60)=25	(90-60)=30	(94-60)=34	(85-60)=25
Bid Unit 3	(80-60)=20	0	(80-60)=20	0

The bids are ranked from high to low as follows: 85, 80, 75, 75, 34, 30, 25, 25, 20, 20, 0, 0. Again, suppose the automated seller's production cost is 70. Thus, the Market price is 75 (that is, the lowest bid above 70). The Market quantity is 4. These 4 sold units are bolded in the table. Following the same rule as in the first 10 trading periods, each of these 4 units will be traded at the Market price 75.

(No Delay only)

To illustrate how a buyer's earnings today are calculated, consider again the case of Buyer 4. Since the Market price is 75, Buyer 4 buys 1 unit. Since the Market quantity is now 4, the **Additional costs per person** are (60/4)*4 = 60. Buyer 4's gross earnings in this period are = 200 (resale value of unit 1) - 60 (tax) – 75 (market price) = 65. Since 4 units are sold, the total tax revenues in this period are 4*60=240. One fourth of the total tax revenues, 240/4=60 points will be returned to buyer 4.

Buyer 4's **Final earnings** in this period = 65 (Gross earnings) – 60 (Additional costs per person) + 60 (returned tax revenues) = 65.

<u>Suppose the tax proposal is rejected.</u>

Trading will continue as before the vote and no changes will apply. Thus, in the above example, the seller will only accept bids above the production cost 70. The Market price is therefore 80. The Market quantity is 10. The additional costs per person are (60/4)*10 = 150 points. Buyer 4 buys two units. Her final earnings for that period are 30.

(Delay and Remove only)

To illustrate how a buyer's earnings today are calculated, consider again the case of Buyer 4. Since the Market price is 75, Buyer 4 buys 1 unit. Since 4 units are sold, the total tax revenues in this period are 4*60=240. One fourth of the total tax revenues, 240/4=60 points will be returned to buyer 4.

Buyer 4's **Final earnings** in this period are = 200 (resale value of unit 1) - 60 (tax) – 75 (market price) + 60 (returned tax revenues) = 125.

Since the Market quantity is now 4, in this period the **Additional costs per person** are (60/4)*4 = 60 points. These additional costs will not affect Buyer 4's earnings today but will be deducted from the $18 cash payment Buyer 4 will receive next week.

So, the final **cash payment each buyer will receive next week = $18 - the sum of the Additional Cost per person in each period.**

(Delay only)

Suppose the tax proposal is rejected.

(Remove only)

Before starting, you and the other three participants in your market can vote whether you are in favor of the introduction of the tax. The tax will be removed only if at least three out of four buyers in each market vote "No".

Suppose the tax of 60 points per unit is removed as the outcome of the voting in your market.

(Delay and Remove only)

Trading will continue as before the vote and no changes will apply. Thus, in the above example, the seller will only accept bids above the production cost 70. The Market price is therefore 80. The Market quantity is 10. Buyer 4 buys two units. Her final earnings for that period are 180.

Since the Market quantity is now 10, in this period the additional costs per person are (60/4)*10 = 150 points. Again, these additional costs will be deducted from the $18 cash payment Buyer 4 will receive next week.

(All treatments)

All final earnings in the following periods will be calculated as illustrated above.

You will be informed about the outcome of the vote in your group on the screen before the trading continues. Nobody, however, will be informed about individual votes of other participants. In the ballot, all participants simultaneously vote Yes or No for the introduction of the tax. Abstentions or neutral votes are not possible. Voting is anonymous.

Before proceeding to the vote you will be asked to do an exercise to make sure you understand the instructions.

If you now have questions, please, raise your hand and wait until an experimenter will come by to answer your questions individually.

B. Content analysis of survey answers

B.1 Instructions

Thank you for coming! You've earned $5 for showing up on time, and the following instructions will explain your task in this session.

<u>Your task:</u>

You will be given a list of messages. Your task is to evaluate whether each of the messages can be classified as expressing of one of the following reasons: (you may assign more than one reasons to a message)

- **I don't like tax**
- **I want to make more money: today, next week, unclear**
- **Preference for Default**
- **Too difficult/confusing to understand the new rules**
- **Practice made me change my mind**
- **Other**

The messages were written by participants in a market experiment. The experiment consisted of 3 stages and 20 periods in total[15].

- For the first 10 periods, participants decided whether and how many units of a hypothetical consumption good to purchase in a market. The first instructions' set attached below explains how each participant made a decision in the first 10 periods.
- After 10 periods of trading, participants were asked to vote Yes or No for the introduction of a tax on the purchase of each unit of the good. If the majority voted for the introduction of the tax, participants would experience the tax for 5 trading periods. The second instructions' set attached below explained to the participants how the tax would affect their earnings in each period.
- The participants were asked to vote a second time whether to introduce the tax at the beginning of period 16; this voting outcome was applied to the last 5 trading periods.

[15] During the experiment, the subjects did not know the exact number of periods in each stage.

At the end of the experiment, each participant was asked to fill out a survey. The messages you will be asked to evaluate are answers to either the question: **"How did you decide to vote in favor or against the tax?"** or to the question **"If your second vote was different from your first vote during the experiment, why did you change your mind?"**

More instructions for coding each message: (you may assign more than one reasons to a message)

1) You should classify a message as "**I don't like tax**", if the message suggests a general dislike/disapproval/mistrust for tax.
2) You should classify a message as "**I want to make more money**", if the message suggests that increasing the earnings is the motivation for the vote. For this category, you will need to further indicate whether the message writer wants to make more money **today**, **next week,** or whether **the timing is unclear**.
3) You should classify a message as "**Preference for Default**", if the message suggests a preference for continuing the game as before without introducing any new element.
4) You should classify a message as "**Too difficult/confusing to understand the new rules**", if the message suggests that the introduction of the tax, and the new rules that had to be understood for this purpose, made the experiment too complicated, or confusing, or the subject did not want to make the effort of understanding them.
5) You should classify a message as "**Practice made me change my mind**", if the message suggests that experiencing the tax in the previous periods was the reason for voting Yes or No the second time.
6) You should code a message as "**Other**", if the message does not fit any of the previous categories. In this case, please briefly explain how you would interpret the message.
7) You should **independently** code all messages. Do not discuss with anyone else in this room about how to code the messages.
8) Your job is to capture the underlying reasons for the voting behavior that can be inferred from the message. Think of yourself as a "coding machine."
9) When you complete the coding, go through the entire list of messages a second time to (1) review all your codes and revise them if needed for accuracy; (2) make sure you code every message.

Each participant will be paid another **$10** for completing the coding task. The session ends after everyone has finished the coding task.

Every two participants will be assigned the same set of messages to evaluate. At the end of the session, two messages will be randomly selected and you will be paid another **$2** for each message that you and the other participant who received the same set of messages coded in the same way.

To evaluate the messages, you need to first understand the experiment. The instructions attached below are the instructions the participants read in the experiment. Please read them carefully.

B.2 Results

The following tables B.2a and B.2b list the frequency of messages that are classified under each category.[16] Table B.2a shows the distribution of classification of the messages for the first question: "How did you decide to vote in favor or against the tax?" Table B.2b shows the distribution of classification of the messages for the second question: “If your second vote was different from your first vote during the experiment, why did you change your mind?” In classifying each message, each coder could choose more than one category. For those messages classified under more than one category, when the two coders agreed on at least one of the categories, we considered that as an agreement and we picked the agreed upon one as the final classified category for the message. It turns out that for each message there is no more than one category agreed to by both coders. The listed classification outcomes in the Tables B.2a and B.2b are only for the messages that coders reached an agreement upon. The last two columns in each table contain the total number of messages and the total number of messages with agreements in each treatment, respectively.

[16]In computing the Cohen’s inter-rater reliability statistic we merged the categories “Too difficult/confusing to understand the new rules” and “Other.” When coding a message in the “Other” category, coders were asked to add a comment. In most cases, the reason for coding a message under the “Other” category was that the message implied a lack of understanding of the question, so the two categories were merged. Also, since each rater could classify each message into more than one category, in cases in which more than two categories were indicated and there was at least one agreement, we considered the agreed upon category. Finally, five buyers did not answer question 1. We also exclude two messages: one wrote “N/A” and the other wrote “no”.

Table B.2a: Distribution of classification of the messages for the first question

Frequency (%)	**Classification Categories**					
	I don't like tax	I want to make more money	Preference for Default	Too difficult or confusing to understand the new rules/other	Number of messages	Number of messages with agreement
"Yes" Voters						
No Delay	0(0%)	35(89.7%)	0(0%)	4(10.3%)	45	39
Delay	1(5.3%)	16(84.2%)	0(0%)	2(10.3%)	21	19
Remove	2(14.3%)	11(78.6%)	0(0%)	1(7.1%)	17	14
"No" Voters						
No Delay	2(8.7%)	13(56.5%)	1(4.3%)	7(30.4%)	29	23
Delay	13(31.7%)	12(29.2%)	4(9.8%)	12(29.3%)	48	41
Remove	7(17.1%)	16(39.0%)	6(14.6%)	12(29.3%)	45	41

Table B.2b: Distribution of classification of the messages for the second question

Frequency (%)	I don't like tax	I want to make more money	Preference for Default	Too difficult or confusing to understand the new rules/other	Practice made me change my mind	Number of messages	Number of messages with agreement
	Classification Categories						
"Yes" Voters							
No Delay	0(0%)	1(33.3%)	0(0%)	1(33.3%)	1(33.3%)	3	3
Delay	0(0%)	1(20.0%)	0(0%)	1(20.0%)	3(60.0%)	6	5
Remove	0(0%)	1(33.3%)	0(0%)	1(33.3%)	1(33.3%)	5	3
"No" Voters							
No Delay	0(0%)	9(69.2%)	0(0%)	1(7.7%)	3(23.1%)	18	13
Delay	0(0%)	4(40 %)	1(10%)	2(20%)	3(30%)	10	10
Remove	0(0%)	5(55.6%)	1(11.1%)	2(22.2%)	1(11.1%)	11	9

C. Time discounting and voting for Tax

C.1 No Delay treatment

In the No Delay treatment, the external cost of trading is deducted from the subjects' earnings on the day of trading. With the immediate externality, each buyer's pretax payoff in each trading period is:

$$\pi_i = \sum_j d_{ij}\pi_{ij} - \sum_i \sum_j d_{ij} MEC_i \qquad \text{(C.1.a)}$$

where $d_{ij} = 1$ if the j^{th} unit is traded in this period and $d_{ij} = 0$ otherwise. π_{ij} is measured as the difference between the resale value of the j^{th} unit and the market price. In our setting, $MEC_i = 15$. As shown in Figure 1, the marginal payoff or marginal benefit of each additional consumption unit is positive and decreasing. Thus, buyers have an incentive to trade all three units available in each period. Without tax and assuming buyers trade at market equilibrium, buyer $i's$ maximum payoff in each period is $\pi_i^* = 40$.

With taxation, an amount equal to the marginal external cost $T = MEC=60$ is paid by each buyer on each unit traded and an equal share of the total tax revenues collected in each market in each period is returned to each buyer. The after-tax payoff becomes:

$$\pi_{i,tax} = \sum_j d_{ij}\pi_{ij} - \sum_i \sum_j d_{ijk} MEC_i - \sum_j d_{ij} T + \frac{\sum_i \sum_j d_{ij} T}{n}$$

$$= \sum_j d_{ij}\pi_{ij} - \sum_j d_{ij} T \qquad \text{(C.1.b)}$$

As shown in Figure 1, the tax shifts the demand curve downwards, from D_0 to D_1. The marginal payoff is positive only for the first two units. As a consequence, the profit-maximizing strategy for each buyer is to purchase two units. In this case, assuming buyers trade at market equilibrium, buyer $i's$ maximum payoff in each period is $\pi_{i,tax}^* = 70$. So, subjects should vote for the tax if they are maximizing their payoff.

C.2 Delay and Remove treatments

When the externality of consumption at time t is delayed to time $t+1$, each buyer's pretax payoff in each trading period is:

$$\pi_{it} = \sum_j d_{ijt}\pi_{ijt} - \beta \sum_{\tau=1}^{T-t} \gamma^\tau \sum_i \sum_j d_{ij} MEC_i \qquad \text{(C.2.a)}$$

where $\gamma=1/(1+r)$ and r is the discount rate and $0<\beta\leq 1$. The value $\beta=1$ produces the standard model of constant (exponential) discounting, and if $0<\beta<1$ there is quasi-hyperbolic discounting.

In the latter case, subjects at time *t* discount the payoff in *t+1* at a higher rate than the one used to discount, at time *t+1,* the payoff at time *t+2*.

As there are only two time periods with one week interval, we can rewrite (C.2.a):

$$\pi_{it} = \sum_j d_{ijt}\pi_{ijt} - \beta\gamma \sum_i \sum_j d_{ij} MEC_i \quad \text{(C.2.b)}$$

Since $0 \leq \beta\gamma \leq 1$, as in the No Delay treatment the marginal payoff or marginal benefit of each additional consumption unit is positive. Thus, buyers will trade all three units available in each period. Without tax and assuming buyers trade at market equilibrium, buyer *i's* maximum payoff in each period is $\pi_{it}^* = 220 - 180\beta\gamma$.

With a tax *T=MEC* =60 on each traded unit and returning the total tax revenues equally to each participant in the market, the after tax payoff is:

$$\pi_{it,tax} = \sum_j d_{ijt}\pi_{ijt} - \beta\gamma \sum_i \sum_j d_{ij} MEC_i - \sum_j d_{ijt} T + \frac{\sum_i \sum_j d_{ijt} T}{n} \quad \text{(C.2.c)}$$

The marginal payoff is positive only for the first two units and thus each buyer will purchase two units when tax is imposed. Assuming buyers trade at market equilibrium, buyer *i's* maximum payoff in each period is $\pi_{it,tax}^* = 190 - 120\beta\gamma$.

If subjects are profit maximizers they will vote for the tax when: $\pi_{it,tax}^* \geq \pi_{it}^*$. (C.2.d)

Solving condition (C.2.6) for $\beta\gamma$ when subjects trade at equilibrium under our parameter setup, we obtain $\beta\gamma \geq 0.5$. Thus, if a significant proportion of buyers satisfies $\beta\gamma < 0.5$, we should observe significantly less buyers voting for taxation in the two delay conditions compared to the No Delay treatment.

D. **Instrumental Variables Probit Analysis of Second Vote**

The regressions reported in Table 3 potentially suffer from an endogeneity problem given that tax experience is partially determined by a buyer's own behavior. To test the robustness of the tax experience effect, we estimated a bivariate probit model in which tax experience is instrumented with the number of yes votes in the first ballot of the other buyers in the same group. During the experiment, buyers were never informed exactly on how many buyers voted yes or no but only on whether the tax is introduced or not. When a buyer voted no the first time, he/she was not be able to infer the exact number of yes votes based on the outcome of ballot. For example, if the ballot outcome is to implement the tax, the number of yes votes of the other three buyers can be either 2or 3. If the outcome is not to implement the tax, the number of yes votes can be either 0 or 1. Thus, we can assume that a buyer's voting decision in the second ballot is independent of the number of yes votes in the first ballot. In contrast, it may not be appropriate to use this instrumental variable for those who voted yes the first time. The reason is that when a buyer voted yes the first time, if the tax is not introduced, he/she can infer that all the other three buyers voted no. So here we report a bivariate probit model only for those who voted No the first time, which is also what we are mostly interested in.

Since we have only one instrumental variable, we conduct a bivariate probit model for each treatment separately. The results are reported in Table D. Consistently with the findings in regression (1) in Table 3, tax experience is significantly positive in the No Delay treatment. In the Remove treatment, tax experience has no significant impact. Although we find the tax experience is signicantly positive in the Delay treatment, the coefficient is smaller than that for the No Delay treatment.

In sum, the regression analysis suggests that tax experience has a significantly positive impact on tax attitude in No Delay treatment. Such an effect is much weaker or insignificant in the delay conditions.

Table D: Bivariate probit regression of voting behavior in the second ballot, by treatment

Dependent variable: $Vote_i$ = 1 if buyer i voted Yes in the second ballot and **Yes** in the first ballot			**Dependent variable:** $Vote_i$ = 1 if buyer i voted Yes in the second ballot and **No** in the first ballot	
	Coef.	**Std. Err.**	**Coef.**	**Std. Err.**
NDtaxexperience	0.824	0.619	1.973***	0.281
Dtaxexperience	-1.226***	0.581	0.183	0.387
Rtaxexperience	-1.171	0.595	-0.959	0.485
Constant	1.044***	0.445	-0.967***	0.150
Dependent variable: $NDtaxexperience_i$=1 if buyer i traded with the tax between period 11 and 16			**Dependent variable**: $NDtaxexperience_i$=1 if buyer i traded with the tax between period 11 and 16	
Othvyes1	0.756	0.169	1.777***	0.331
Constant	-1.035	0.297	-3.832***	0.669
Rho	-0.393	0.476	-0.995	0.798
LR test of Rho=0Chi^2(1)	0.571(*p-value*=0.450)		1.806(p-value=0.179)	
Wald Chi^2(4)	30.58		88.87	
#obs	83		129	

Table D: Bivariate probit regression of voting behavior in the second ballot, by treatment

No Delay			Delay			Remove		
Dependent variable: $Vote_i$ = 1 if buyer i voted Yes in the second ballot and **No** in the first ballot			**Dependent variable:** $Vote_i$ = 1 if buyer i voted Yes in the second ballot and **No** in the first ballot			**Dependent variable:** $Vote_i$ = 1 if buyer i voted Yes in the second ballot and **No** in the first ballot		
	Coef.	**Std. Err.**		**Coef.**	**Std. Err.**		**Coef.**	**Std. Err.**
Taxexperience	2.443***	0.385		1.254***	0.487		0.614	0.636
Constant	-1.919***	0.247		-1.573***	0.183		-1.581***	0.183
Dependent variable: $taxexperience_i$=1 if buyer i traded with tax between period 11 and 16			**Dependent variable**: $taxexperience_i$=1 if buyer i traded with the between period 11 and 16			**Dependent variable**: $taxexperience_i$=1 if buyer i traded with tax between period 11 and 16		
Othvyes1	17.198	1.04e+08		17.588	5.31e+07		17.744	1.17e+08
Constant				-26.401	7.49e+07		-26.590	1.39e+08
Rho	-5.71e-14	7.64e+07		1.50e-14	4.67e+07		3.78e-13	6.42e+07
LR test of Rho=0Chi^2(1)	3.2e-08	0.999		7.8e-08	0.627		1.1e-11	1.000
Wald Chi^2(2)	40.30			6.63			0.93	
#obs	129			129			129	

Note: ** and *** indicate statistical significance at 5 % and 1 % level.

Othvyes1= 1 if the other buyers in the same group of buyer *i* voted yes in the first ballot.