Time Delay, Complexity and Support for Taxation

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Abstract

People often experience the benefits of taxation over time. We design a novel intertemporal market experiment with negative externalities to examine the effect of delaying the benefits of taxation on support for taxes. We find people are less willing to accept Pigouvian taxes, aimed at reducing negative externalities and restoring market efficiency, when negative externalities are delayed. While people learn to adopt taxation when the negative externality occurs immediately, the resistance to taxation persists over time when the externality is delayed. Our data reveal that the increased perceived complexity of the environment, rather than time discounting per-se, plays an important role in explaining the strong negative delay effect. We argue and demonstrate that increasing the transparency of intertemporal tradeoffs can effectively promote support for appropriate 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 may now be shifting towards supporting the United States taking action on climate change. There appears to be substantial agreement 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. 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 over time. Stock externalities are a typical example of externalities with time delay. Consumers obtain the benefit of consuming gasoline right away but pollution only accumulates over time. When externalities are caused by a stock of pollution rather than a flow, and when stocks decay slowly, as with greenhouse gases, the problem is dynamic and current emissions can cause future environmental damage. Stock externalities imply that costs and benefits of policy measures, such as Pigouvian taxation, occur at different

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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.
times. Delaying the benefits of taxes can be a major reason for not supporting them, and this is particularly the case for Pigouvian taxes.

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 et al., 2002). This literature investigates many important phenomena, with one focus being on individual decision making without externalities where one’s future welfare is affected largely by one’s own decisions, such as saving or forming healthy habits. To the best of our knowledge, no study has considered intertemporal choices with externalities where each subject’s future welfare is influenced not only by her own decisions but also by the decisions of others. For example, the future benefit of introducing Pigouvian taxes is determined not only by one’s own consumption behaviour but also by the behaviour of other participants in the market. Decision-making in such contexts can be more complicated than individual intertemporal choices without externalities.

To understand the role of intertemporal delay in public support for taxation, we design a novel intertemporal 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. 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 units of a consumption good in a market for 10 periods, then 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. Participants are then given another opportunity to vote on taxation for the last five periods.

For our experiment to inform the underlying mechanism of the potential delay effect on tax support, we design the parameters such that to find less support for taxation in the Delay treatment in comparison to the No Delay treatment would require an extremely high one-week discount rate according to a simple exponential time discounting model. Interestingly, even in this setting, we observe robust evidence 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. Second, 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 what we find in the Delay treatment. This suggests that people learn to adopt the tax over time when the external cost is immediate, but not when it is delayed. Last, the rate of support for taxation remains low (and
unchanged) in the Delay condition even when the tax is framed as the default and participants must vote not to implement it (Remove treatment). The absence of a 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 provide evidence suggesting the perceived complexity of the intertemporal environment as the source of the strong delay effect on support for taxation in our setting. Narrow bracketing contributes to the low support rate in the delay conditions. We observe gender differences in the voting decisions that are consistent with previous findings of gender differences in narrow bracketing. Data from another treatment (Delay_Transparency treatment) show that we can eliminate the detrimental delay effect by providing participants explicit information about the intertemporal tradeoffs involved in the tax voting decision. We 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 describes and reports results from Delay_Transparency treatment. Section 7 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, 2014) 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, 2014). A related strand in the public finance literature has tested other misperceptions of taxes. Sausgruber and Tyran (2005) demonstrate that buyers systematically underestimate the tax burden of a tax levied on sellers. More recently, Blumkin et al. (2012) have added experimental evidence on “money illusion” by showing that
individuals underestimate the burden associated with an indirect consumption tax (that erodes real purchasing power) relative to the corresponding burden associated with a direct wage tax.

Little is known about people’s attitudes towards taxation in an intertemporal setting where the cost and benefit of paying taxes 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 is introduced by letting a player’s contribution capabilities depend on the past behavior of that player and her group (Battaglini et al. 2014; 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 consumption taxes.

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. Research on intertemporal individual choice has shown that higher cognitive loads make people more present-biased and more likely to succumb to visceral temptations (Shiv and Fedorikhin, 2002). Brown et al. (2009) find lower values of the present bias parameter $\beta$ in more complex environments compared to less complex ones. 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 $\beta$).\(^2\)

The relationship between complexity and myopic choices may be explained by narrow bracketing, i.e. individuals making separate sequential decisions in each time period rather than considering the consequences of their current choices for their future payoff (Read et al. 1999). Narrow bracketing is more likely to occur when the future consequences are too complicated to consider (Gabaix and Laibson, 2006). Complementing this previous research, we highlight the role of complexity in an important decision context. Consistent with previous findings, our study suggests narrow bracketing explains subjects’ attitude towards taxation when the benefit of the tax is delayed.

\(^2\)For example, they find for their sophisticated consumers a present bias parameter as low as 0.273 which increases to 0.585 after private learning has occurred.
To the best of our knowledge, our paper provides the first laboratory experiment evidence on the role of real time-delayed tax benefits on tax attitudes. As made clear below, our experiment design is related to three strands of experimental research: laboratory markets 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 an intertemporal 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 that 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 administer a survey to elicit the subjects’ one-week discount rate and to obtain feedback 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 exactly one week after the end of the experiment without having 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 and 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 email. 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 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 (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

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3 To minimize any transaction costs implied by going back to the lab, subjects were given the possibility to reschedule the pickup time or the pickup day. Subjects could also send someone else, on their behalf, to pick up their second payment.
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:

\[
\pi_{ik} = \sum_j d_{ijk} \pi_{ijk} - \sum_i \sum_j d_{ijk} MEC_{ik}
\]

where \( d_{ik} = 1 \) if the \( j^{th} \) unit is traded in period \( k \) and \( d_{ik} = 0 \) otherwise.

In our experimental setting, it is easy to calculate that, at market equilibrium, without taxation, all buyers purchase three units at a price of 40 (see \( D_0 \) in Figure 2). Earnings per buyer are 40 points per period 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:

\[
\pi_{ik,\text{tax}} = \sum_j d_{ijk} \pi_{ijk} - \sum_i \sum_j d_{ijk} MEC_{ik} - \sum_j d_{ijk} T + \frac{\sum_i \sum_j d_{ijk} T}{n}
\]
As shown in Figure 2, the tax shifts the demand curve downwards, from \( D_0 \) to \( D_1 \). 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 support for taxation 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 external costs symmetrical across treatments, we show each buyer the external costs incurred 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:

\[
s_{t,t+1} = \delta \left( \sum_{j} \sum_{d} d_j \text{MEC}_j \right)
\]

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

### 3.2 Voting

\(^4\) 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 does not change the market price and quantity but only the surplus. In particular, the total surplus gained at equilibrium on each of the three units in the experiment is 160-15-40; 110 -15-40 and 70-15-40, respectively.
In the Delay and No Delay treatments, at the beginning of period 11 subjects vote for the introduction of a revenue neutral Pigouvian tax. The tax rate is equal to the marginal external cost \( T = \frac{MEC}{60} \) 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 divided equally among buyers and returned 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 (Casari and Luini, 2009)\(^5\). Similar to previous studies (Markussen et al. 2014), each participant is informed about the voting outcome 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 apply 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 delaying 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 individual voting 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 introduced by Coller and Williams (1999). Subjects are given a set of nine decisions.

\(^5\) Casari and Luini show that peer punishment in public good games is carried out only when there is a coalition of two or more agents sharing the same norm.
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 discount 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) 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. To make sure subjects understood the instructions, each one had to finish a comprehension quiz before making any decisions.

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. 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
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 presence of immediate externalities.

A profit-maximizing buyer $i$ will support the tax as long as the profit under the tax regime ($\pi_{i,\text{tax}}$) is higher than without the tax ($\pi_i$). Condition $\pi_{i,\text{tax}} \geq \pi_i$ 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) (see Appendix C for details). In particular, at equilibrium each buyer will earn 30 additional points in each period when there is a tax compared to when the tax is not introduced. 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 voting behavior when the externality is delayed. First, let’s consider the impact of time discounting. The discount factor used to compare payoffs at time $t$ and $t+1$ is $\beta \gamma = \beta(1+r)$, where $r$ is the (weekly in our setting) 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 $t+2$. With this simple intertemporal structure of the external costs from consumption, each subject $i$’s pretax payoff in each trading period $k$ becomes:

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

As a first step, our experiment introduces only one type of subjects, i.e. those who both produce externalities and are 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 bear the external costs without producing 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.

Since each trading period $k$ has the same set up, to ease notation we henceforth omit the “$k$” subscript from payoff functions.
where $\tau$ 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

$$\pi_{it} = \sum_j d_{ijt}\pi_{ijt} - \beta\gamma(s_{i,t+1})$$

(4.a)

and the after-tax payoffs becomes

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

(5)

In our experimental setting, comparing $\pi_{it,\text{tax}}$ and $\pi_{it}$, we find that when the tax is introduced subjects will earn 30 points less at time $t$ but will earn 60 points more at time $t+1$. 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. The reason is that in both cases, the tax will increase each buyer’s profit by 30 points per period. For $\beta\gamma < 1$, condition $\pi_{it,\text{tax}} \geq \pi_{it}$ holds if $\beta\gamma \geq 0.5$ or $\gamma \geq 0.5/\beta$ (see Appendix C for details). This result suggests that, if time discounting alone is the reason for any delay effect on tax support, we will observe a different voting behavior in the Delay and No Delay treatments only when the individual discount rate is extremely high. In our setting, a lower support in the Delay case compared to the No Delay case implies buyers value 30 points earned today more than 60 points to be earned in a week. In other words, if we assume exponential discounting ($\beta=1$), voting against the tax means the buyer has a one-week discount factor $\gamma < 0.5$ (i.e., $r > 100\%$).\footnote{Note that a one-week discount rate of $1\%$ already implies an annual discount rate of $67.76\%$.}

Although such a high discount rate does not seem to be possible, we conducted a survey to examine whether that is the case in our experiment. We note, however, that the intertemporal environment in which our subjects make their voting decisions is much more complicated than a survey where the tradeoff between a smaller immediate reward and a bigger delayed reward is explicit. As we mentioned in section 2, due to bounded rationality, people often overdiscount or overlook the future in computationally difficult intertemporal environments (Brown et al. 2009; Read et al. 1999; Gabaix and Laibson, 2006). In the delay conditions, the benefit of introducing the tax (the deduction of the external cost) is determined not only by one’s own trading behavior but also the other three buyer’s trading behavior. Thus, the future benefit of the tax may be difficult to compute. As a result, buyers may decide whether to support the tax mainly considering today’s payoffs with little regard for payoffs next week, and the delay in externalities significantly reduces support for taxation that improves future payoffs.
Therefore, even if the survey suggests a low discount rate, we still expect to observe a lower support for the tax in the Delay conditions if the decision environment is sufficiently complicated for buyers.

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

In the Remove treatment, we frame the tax as the default institution by informing subjects that at the beginning of period 11 (and also at the beginning of period 16), a tax will be introduced for the following trading periods, but they can vote no if they want to remove it. The previous literature on the default effect has shown that people are significantly more likely to adopt a policy, such as organ donation, when it is framed as the default (Johnson and Goldstein, 2003). There are several reasons for the default effect. People may stay with the default simply because it implies lower transaction costs when the default means no action has to be taken. As we elicit people’s attitude towards taxation based on their choices, we design the Remove treatment such that people still need to vote. That is, the voting decision screen of the Remove treatment is exactly the same as the Delay treatment. The only difference between the two is that, in the voting instructions, the tax is framed as a default. Thus, our design of the Remove treatment can be considered as a weak form of default setting. Yet, we still expect the default may increase support for taxation if it makes the tax a cognitively easier choice (Gigerenzer, 2008) or if it leads subjects to perceive imposing the tax as the norm or as an implicit recommendation from the policy maker (or from the experimenter in the experiment) (McKenzie et al. 2006).

**Prediction 4** (Default and voting on tax): *Compared with the Delay treatment, more buyers vote for the tax when the tax is framed as the default choice in the Remove treatment.*

**5 RESULTS**

In the next section we report the market quantity over time in each treatment. Since our interest is in support for taxation, our analysis focuses on 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**
5.1.1 Market Quantity

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, $p > 0.50$). 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 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 (84%) adopt Pigouvian taxation in the No Delay treatment. In the Delay and Remove treatments, only 28% 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).

5.1.2 Market Price

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, $p = 0.491$; No Delay vs. Remove, MW test, $p = 0.556$), 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.

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9 In all the non-parametric tests, we calculate the average at group level and treat each group as an independent observation.
across treatments (periods 11-15: 41.116 in No Delay, 41.556 in Delay, and 40.575 in Remove; periods 16-20: 40.421 in No Delay, 40.678 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

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, the support rate for taxation is significantly lower in the Delay and Remove treatments than in the No Delay treatment (29.15% Delay vs. 59.21% No Delay, MW test, \( p < 0.01 \); 26.55% Remove vs. 59.21%, 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 (59.21% first ballot vs. 78.95% second ballot, MW test, \( p < 0.01 \)). In the Delay and Remove treatments, the difference in voting behavior between the two ballots is not significant (29.15% vs. 33.33%; 26.55% vs. 32.81%, MW tests, \( p > 0.10 \)). 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 (33.33% vs. 78.95%, 32.81% vs. 78.95%, MW tests, \( p < 0.01 \)). This suggests that people may learn the benefits of taxation 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 the rate of 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 compared to the Delay (19.74% vs. 4.17%, MW test, \( p = 0.03 \)). Such a difference is also higher in the No Delay compared to the Remove treatment, although it is not statistically significant (19.74% vs. 6.25%, MW test, \( p = 0.12 \)).

Prediction 4 is not supported by our data. 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. This non-significant difference between the Delay and Remove treatments may be due to the weak treatment manipulation we introduced in the Remove treatment. As we discussed in the Predictions section, in previous studies on the default effect participants do not have to take any action when choosing the default. In contrast, buyers in the Remove treatment still have to vote yes or no for the tax. In addition, we note that unlike previous studies (Abadie and Gay, 2006; Choi et al., 2004; Levav et al. 2010, to cite a few), in our experiment the “default” (i.e. implementing the tax) actually consists of making a change to the situation 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.

In all treatments, a few subjects did not pick up the second payment. The pickup rate in the NoDelay treatment is significantly higher than that in the Delay and Remove treatments (97% vs. 83%; 97% vs. 81%, MW tests, p<0.01). Such differences are not surprising as the second payment in the NoDelay treatment is higher than in the Delay and Remove treatments. To investigate whether the differences in the pickup rates contribute to the delay effect, we compare the number of yes votes only for those who picked up their second payment in the following week. In both the first and the second ballots, support for the tax is again significantly much lower in the Delay and Remove treatments than in the No Delay treatment (first ballot: 30.13% Delay vs. 58.77% No Delay; 31.77% Remove vs. 58.77% No Delay; second ballot: 31.41% Delay vs. 79.82% No Delay; 40.63% Remove vs. 79.82% No Delay, MW tests, p<0.01). These results show that the delay effect cannot be attributed to differences in pickup rates.

5.2.2 Individual differences in voting behavior

Voting decisions in the first ballot

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 predictions section). To see if profit maximizing subjects are more likely to vote for the tax, we examine the correlation between purchasing 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 utility-maximizing. In Table 2, we report results of a random group effects probit regression analysis of voting behavior (Fstyes\(_i=1\) 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 (\(\bar{FQ}_1\)), the average number of units bought by the other three buyers in the same market in the first five trading periods (\(\bar{OFQ}_1\)), the number of units bought by a buyer in the second five trading periods (\(S\bar{Q}_1\)), and the average number of units bought by the other three buyers in the same market in the second five trading periods (\(\bar{OSQ}_1\)). 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 her own preference for profit-maximization, but also by her group members’ trading behavior. The results are shown in Table 2.

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 \(\bar{FQ}_1\) is significant. This suggests that those buyers who tend to purchase more units in the market are more likely to vote for the tax.

*Comparison of the two voting decisions*

We next examine how people’s attitudes towards taxation may change over time and how the delay affects such changes. The aggregate voting behavior suggests 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 switched 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.

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10 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.

11 We allowed for treatment differences in “\(\bar{FQ}_1\).” As there is no treatment difference, we pooled the three variables together.
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. 21.6%, MW test, p<0.01) and between the No Delay and Remove treatments (63.7% vs. 19.3%, 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 (21.6% vs. 19.3%, MW test, p=0.684).

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=0.039; 4.9% No Delay vs. 13.6% Remove, MW-test, p=0.274).

These results suggest that, compared with delayed benefits, when the benefits are immediate people are not only more likely to initially vote for taxation but also more likely to switch to support taxation if they did not at the beginning. 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 the tax in place between period 11 and 15 in the No Delay treatment than in the Delay and Remove treatments (64.52% vs. 15.69% and 12.77%). 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. We allow different coefficients for each treatment. We conduct this

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12 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
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) shows 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 ($\beta_1$). 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 ($\beta_2$ and $\beta_3$) and we do not observe such a negative effect in the No Delay treatment ($\beta_1$ is positive but not significant). In both regressions, the tax experience effect in No Delay is jointly significantly different from the other two treatments ($\beta_1$ is jointly significantly different from $\beta_2$ and $\beta_3$, \textit{chi-square test, p}<0.05). The negative tax experience effect in the two delay conditions can be explained by the fact that buyers in these two treatments see that current earnings are actually lower when the tax is introduced although the amount of external costs deducted from next week’s earnings is smaller. If buyers focus on current earnings, they will switch to vote no in the second ballot.

These results provide insights to help understand how people’s attitude towards taxation 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 impact on those who voted no the first time and 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 \textit{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.

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).
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, $r=8.6\%$ in Delay and 9.5% in Remove). Overall, the average one-week discount rate is 10.4% in the No Delay treatment, 11% in the Delay treatment and 12.6% in the Remove treatment. 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 (correlation coefficient between yes in the first ballot and discount rate is $0.019$, $p>0.10$ (Delay); $-0.115$, $p>0.10$ (Remove); between yes in the second ballot and discount rate: $-0.035$, $p>0.10$ (Delay); $-0.141$, $p>0.10$ (Remove))\textsuperscript{13}.

5.4 Complexity and Support for Taxation

We noted in section 4 that the intertemporal decision environment with externalities is much more complicated than the simple intertemporal choices made in the survey. Such a complexity may be an important additional factor leading people to be less willing to vote for the tax when the benefit is delayed even though they do not appear to discount the future that much. The relationship between complexity and myopic choices can be explained by \textit{temporal narrow bracketing}: individuals only consider the consequences of their current decisions on their current payoff and fail to consider the consequences of their current choices on their future payoff (Read \textit{et al.} 1999). In our experiment, the purpose of the tax is to reduce the external costs. To control for the potential salience difference between delayed and immediate external costs, we provide

\textsuperscript{13} We also ran the regressions in Table 2 and 3 by adding $r$ as an explanatory variable, and it was not significant.
participants in all treatments explicit information on the additional costs per person on the outcome screen at the end of each period (see Appendix A.2). However, narrow bracketing implies that buyers’ voting decisions are less likely to be affected by the historical level of the external costs in the Delay conditions compared to the No Delay condition.

5.4.1 External costs and voting decisions

To shed light on the potential role of narrow bracketing, we compare the role of the average external costs during the first 10 periods in buyers’ voting decisions between the Delay and No Delay conditions. We conduct a random effects probit regression analysis of the first voting decision where the random effects capture group heterogeneity. The dependent variable is whether the buyer voted yes in the first ballot (Fstyes). The explanatory variables are the average external costs per person in the first 10 periods and we allow different coefficients for each treatment (NDExtc10, DExtc10 and RExtc10). The regression results are shown in column (1) of Table 4. The coefficient of NDExtc10 is significantly positive (\(p=0.03\)). In contrast, the coefficients of DExtc10 and RExtc10 are only marginally significant (\(p=0.07\)). Both are significantly lower than the coefficient of NDExtc10 (chi-square tests, \(p<0.01\)). This suggests that, compared with the NoDelay treatment, the correlation between support for taxation and the level of externalities is significantly lower when the externalities only affect the future. This result is consistent with narrow bracketing.

5.4.2 Gender differences

Rabin and Weizsacker (2009) found some demographic differences in broad bracketing. For example, the frequency of broad bracketers in their sample is 21 percent among males compared to zero percent among females\(^{14}\). More recently, similar gender differences in narrow bracketing have been found in other domains, such as the allocation of gift certificates income (Felso and Soetevent, 2014), and myopic loss aversion (Hilgers and Wibral, 2014). If narrow bracketing contributes to the delay effect, the gender differences in narrow bracketing would predict that females are less likely to consider the external cost and to vote for the tax than males when the externality is delayed. Our data are consistent with this prediction. While there is no gender difference in the supporting rate in the No Delay treatment, females are much less likely

\(^{14}\) The difference, however, is not strong enough to generate significant differences in the dominance violation rates of their subjects.
to support the tax in the Delay and Remove treatments. (NoDelay: 57% vs. 61%, Z-test, \( p > 0.70 \); Delay: 25% vs. 41%, Z-test, one-tailed \( p = 0.03 \); Remove: 19% vs. 33%, Z-test, one-tailed \( p = 0.10 \)). In Table 4 column (2) we run a regression similar to column (1) but separating females (\( f \)) from males (\( m \)). The results are again consistent with narrow bracketing. We observe no significant gender differences in the coefficients for NDExtc10, but the coefficient for DExtc10 (RExtc10) for females is (marginally) significantly lower than that for males (chi-square tests, \( p > 0.75 \); one-tailed \( p = 0.04 \); one-tailed \( p = 0.10 \), respectively).

5.4.2 Insights from the survey

We also analyze the participants’ answer to the survey questions to examine whether buyers indeed suggest complexity in the voting decisions. 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 for 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, \(p=0.04\)).\(^{15}\) These percentages are 29.3% vs. 10.6% in the Delay (Z-test, \(p=0.11\)) and 29.3% vs. 7.1% in the Remove treatment (Z-test, \(p=0.09\)). The details 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 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 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, \(p<0.10\)).

6 REMOVING COMPLEXITY TO PROMOTE SUPPORT FOR TAXATION

The results reported above suggest that complexity plays an important role in the negative delay effect on support for taxation. Complexity in decision making may lead to narrow bracketing (Read et al. 1999), i.e. to make today’s decisions based on today’s payoffs only, with no regard for future payoffs. In our Delay condition, supporting the tax requires broad bracketing, i.e. choosing a lower payoff today in view of a higher payoff next week. These considerations suggest that a simple solution to promote support for taxation is to provide market participants with explicit information on the intertemporal consequences underlying taxation.\(^{16}\) We conducted a new treatment (Delay_Transparency treatment) to test the effectiveness of this solution to promote tax support.

The only difference between this new treatment and the Delay treatment is that in the voting instructions for the Delay treatment, we added the following sentences after the examples illustrating how the payoffs are calculated when the tax is accepted and when the tax is rejected:

\(^{15}\) 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.

\(^{16}\) A recent paper (Hilgers and Wibral, 2014) shows that choice bracketing is malleable and exogenous feedback on behavior from institutions can lead individuals to shift from narrow to broad bracketing, i.e. subjects who previously narrow bracketed can learn to bracket broadly after receiving useful information.
“These two examples show that with the tax, buyer 4 will earn 125 points today and lose 60 points next week. Without the tax, buyer 4 will earn 180 points today and lose 150 points next week.

That is, compared to the case with no tax, with the tax buyer 4 will earn 55 points less today, but will earn 90 points more next week.”

Thus, the voting instructions in the Delay_Transparency treatment provide buyers with explicit information on the intertemporal tradeoff they are making when deciding whether to vote in favor of the tax.

We implemented the treatment in the same way as the Delay treatment. We recruited 60 participants (15 groups of 4 buyers) from the same subjects pool. After 10 trading periods, buyers were asked to vote for introducing the tax. The voting outcome was implemented for the following five periods. A second ballot was introduced at the beginning of period 16.

Subjects were instructed to come back to pick up the second payment in a week. The pickup rate in this treatment is about 92%, which is lower than the 97% pickup rate in the No Delay treatment and higher than the 83% pickup rate in the Delay treatment although neither of the differences is significant (MW tests, $p>0.10$). Yet, as reported below, we observe a significantly higher support rate in this new treatment than in the Delay treatment and no significant differences in voting behavior between the No Delay and Delay_Transparency treatments. This result offers additional evidence that, as we argued above, the delay effect discovered in this experiment cannot be attributed to the (insignificant) differences in the pickup rates.

We find strong evidences that making intertemporal tradeoffs transparent significantly promotes support for taxation. In both the first and the second ballots, the average number of yes votes per group in the Delay_Transparency treatment is significantly higher than in the Delay treatment. It is as high as in the No Delay treatment (first ballot: 2.533 Delay_Transparency vs 1.166 Delay, MW test, $p<0.01$; second ballot: 2.733 Delay_Transparency vs 1.333 Delay, MW test, $p<0.01$).

We reported in section 5 that, when the benefits of taxation are delayed, people are not only less likely to vote for taxation but also less likely to switch to support taxation when they did not at the beginning. We are interested in whether removing complexity helps voters change their negative attitude towards the tax over time in this new treatment. We calculate the values of
“YesNo”, “NoYes” “NoYes” and “YesYes” as the other three treatments reported in Figure 4. Again, for each group we calculate 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 Delay_Transparency and Delay treatments (41.0% vs. 21.5%, MW test, p=0.05). We cannot reject the null hypothesis that subjects are equally likely to switch from no to yes in the Delay_Transparency and No Delay treatments (41.0% vs. 63.7%, MW test, p=0.13).

Similarly, among those who voted yes the first time, we calculate the probability of buyers to switch from yes to no for each group. This probability in the Delay_Transparency treatment is in between the No Delay and Delay treatments although it is not significantly different from either of the two treatments (14.4% Delay_Transparency vs. 4.9% No Delay and 30.4% Delay, MW tests, p>0.10).

We are also interested in whether providing explicit information about the intertemporal tradeoffs leads people to be more likely to consider the externality when they decide how to vote. We thus include the data from Delay_Transparency treatment (explanatory variable DTExtc10) in the regression reported in Table 4. This regression results are shown in Table 4 column (3). We find that the coefficient of DTExtc10 is significantly positive. The coefficient of DTExtc10 is not different from that of NDExtc10 (chi-square test, p=0.87) but significantly different from DExtc10 and RExtc10 (chi-square test, p<0.01). Interestingly, the gender differences we observed in the two delay conditions disappear in the Delay_Transparency treatment. Females and males are equally likely to support the tax (64% vs. 63%, Z-test, p>0.90). When separating females (f) and males (m) in the regression reported in Table 4 column (4), we find no gender difference in the coefficients of DTExtc10 (chi-square test, p>0.90).

To summarize, data from the Delay_Transparency treatment suggest that, when being provided clear information on the intertemporal tradeoffs, people not only become more likely to vote for taxation, but also more likely to switch to support taxation when they did not at the beginning. We also find evidence that resolving complexity prevents those who initially supported taxation from changing to vote against the tax over time. Moreover, with the help of information, subjects, especially females, seem to be more likely to take into account the future external costs when deciding whether to support the tax.
7 CONCLUSIONS
Incentive-based instruments such as taxes are the main policy tool to address externalities and, more generally, to change behavior since they modify the relative prices agents face. They do so in a cost-effective way, meaning that an 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.

We find that the majority of those who voted against the tax switch to support the tax after having experienced the tax institution. Such a switch does not occur, however, when there is a delay in the negative externality. This suggests that the introduction of trial runs to experience the working and impacts of a new tax policy might boost acceptability when the benefits of the new policy are immediate, but not when they are delayed. It would be interesting to conduct further empirical studies to test whether trial runs, which have been shown to increase taxes’ acceptability both in the lab (Cherry et al. 2014) and in the real world (Schuitema et al. 2010), also work when the benefits of taxation are delayed.

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 increased over time to the target rate. Policy strategies framing the future external costs as more immediate and salient could also 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 necessary 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 a future date (e.g., “vacationing in Paris”) significantly reduced discount rates.
Equally importantly, we demonstrate that exponential time discounting alone is not sufficient to explain the delay effect on the attitude towards tax. When being asked directly to make an intertemporal choice, people do not display the high time discount rate required by theory to explain their voting decisions. Indeed, 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 narrow bracket, that is, to consider the consequences of their current choices only on their current payoffs, but not on the future ones. This is consistent with previous literature on intertemporal choice 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).

We show that providing explicit information about the intertemporal tradeoffs implied by taxation almost completely eliminates the delay effect. While females are less likely to support the tax than males when the externalities are delayed, we observe no gender differences in the voting decisions when participants are provided the explicit tradeoff information. These findings are consistent with narrow bracketing and provide important insights for policy makers. To improve support for Pigouvian taxation, we should consider how to provide credible and easy-to-understand information about the intertemporal tradeoffs under the tax. Such information may be particularly valuable for females.

Manipulating the salience of the external costs could also play a role. It is worth noting that we designed our experiment such that the salience of the negative externality was symmetric across treatments. In particular, in all the treatments, buyers see both immediate and delayed payoffs in the outcome screen at the end of each trading period. The delay effect on support for taxation may be even more significant in naturally occurring environment where people cannot readily understand how any externality will influence their future welfare.
Acknowledgements. This research was supported by a Marie Curie International Outgoing Fellowship (PIOF_GA_298094) within the 7th European Community Framework Programme. We thank Leonardo Boncinelli, Todd Cherry, Daniel Houser, George Loewenstein, Luigi Luini, John Miller, Rupert Sausgruber, Matthias Weber, Alberto Zanardi and participants in the Behavioral and Experimental Economics Workshop, Florence 2013; the Economic Science Association World Meetings, Zurich 2013; the 54th Annual Meeting of the Italian Economic Association, Bologna 2013; the conference on Taxation, Social Norms and Compliance, Nuremberg 2014; Workshop on Behavioral Public Economics (Vienna) and in seminars at Carnegie Mellon University, Milano Bicocca University, the University of Siena, NYU, Nuffield College, University of East Anglia, University of Birmingham, City University of Hong Kong, Chinese University of Hong Kong, Monash University and Maastricht University for valuable suggestions. We gratefully acknowledge Rupert Sausgruber and Jean-Robert Tyran for sharing their z-Tree code used in Sausgruber and Tyran (2005). We also thank David Hagmann for excellent research assistance.
REFERENCES


### 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. ↓ Each 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

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Median</th>
<th>s.e.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No Delay</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First yes</td>
<td>2.368</td>
<td>3</td>
<td>0.256</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Second yes</td>
<td>3.158</td>
<td>4</td>
<td>0.257</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td><strong>Delay</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First yes</td>
<td>1.166</td>
<td>1</td>
<td>0.232</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Second yes</td>
<td>1.333</td>
<td>1</td>
<td>0.198</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td><strong>Remove</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First yes</td>
<td>1.062</td>
<td>1</td>
<td>0.249</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Second yes</td>
<td>1.312</td>
<td>1</td>
<td>0.198</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>
Table 2: Voting behavior in the first ballot and previous trading behavior: Random group effects probit regression model

**Dependent variable:** Fstyes, = 1 if buyer i voted yes in the first ballot

<table>
<thead>
<tr>
<th></th>
<th>Coef.</th>
<th>Std. Err.</th>
</tr>
</thead>
<tbody>
<tr>
<td>( FQ_i )</td>
<td>1.04***</td>
<td>0.39</td>
</tr>
<tr>
<td>( OFQ_i )</td>
<td>0.34*</td>
<td>0.21</td>
</tr>
<tr>
<td>( SQ_i )</td>
<td>-0.46</td>
<td>0.32</td>
</tr>
<tr>
<td>( OSQ_i )</td>
<td>-0.81</td>
<td>0.18</td>
</tr>
<tr>
<td>Delay</td>
<td>-0.85***</td>
<td>0.23</td>
</tr>
<tr>
<td>Remove</td>
<td>-1.06***</td>
<td>0.25</td>
</tr>
<tr>
<td>Constant</td>
<td>-4.88**</td>
<td>2.25</td>
</tr>
</tbody>
</table>

Wald chi^2(6) 26.11

# of obs. 212

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

\( FQ_i \): the average number of units bought by a buyer \( i \) in the first five trading periods.

\( OFQ_i \): the average number of units bought by the other three buyers in a buyer \( i \)’s market in the first five trading periods.

\( SQ_i \): the number of units bought by a buyer \( i \) in the second five trading periods.

\( OSQ_i \): 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: Voting behavior in the second ballot and previous tax experience: Random effects probit regression model

<table>
<thead>
<tr>
<th>Dependent variable: ( Sndyes_i = 1 ) if buyer ( i ) voted Yes in the second ballot</th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Includes only those who voted No in the first ballot</td>
<td>Includes only those who voted Yes in the first ballot</td>
<td></td>
</tr>
<tr>
<td><strong>β</strong>: NDtaxexperience</td>
<td><strong>β</strong>: Dtaxexperience</td>
<td><strong>β</strong>: Rtaxexperience</td>
</tr>
<tr>
<td>( \beta_1 ): NDtaxexperience</td>
<td>1.444***</td>
<td>0.504</td>
</tr>
<tr>
<td>Std. Err.</td>
<td>0.331</td>
<td>0.504</td>
</tr>
<tr>
<td><strong>β</strong>: Dtaxexperience</td>
<td>0.601</td>
<td>-0.976*</td>
</tr>
<tr>
<td>Std. Err.</td>
<td>0.476</td>
<td>0.538</td>
</tr>
<tr>
<td><strong>β</strong>: Rtaxexperience</td>
<td>-0.048</td>
<td>-0.933*</td>
</tr>
<tr>
<td>Std. Err.</td>
<td>0.627</td>
<td>0.564</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.920***</td>
<td>1.187***</td>
</tr>
<tr>
<td>Std. Err.</td>
<td>0.150</td>
<td>0.396</td>
</tr>
</tbody>
</table>

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.
**Table 4:** Voting behavior in the first ballot and external costs: Random group effects probit regression model

**Dependent variable:** \( \text{Fstyes}_i = 1 \) if buyer \( i \) voted Yes in the first ballot

<table>
<thead>
<tr>
<th></th>
<th>Coef. (1)</th>
<th>Coef. (2)</th>
<th>Coef. (3)</th>
<th>Coef. (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{NDExtc10}_i )</td>
<td>0.028** (0.013)</td>
<td>0.022** (0.018)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \text{DExtc10}_i )</td>
<td>0.024* (0.013)</td>
<td>0.018 (0.012)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \text{RExtc10}_i )</td>
<td>0.023* (0.013)</td>
<td>0.017 (0.012)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \text{DTExtc10}_i )</td>
<td>0.023** (0.012)</td>
<td>0.023** (0.012)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \text{mNDExtc10}_i )</td>
<td></td>
<td>0.027** (0.013)</td>
<td>0.022* (0.012)</td>
<td></td>
</tr>
<tr>
<td>( \text{fNDExtc10}_i )</td>
<td></td>
<td>0.027** (0.014)</td>
<td>0.021* (0.012)</td>
<td></td>
</tr>
<tr>
<td>( \text{mDExtc10}_i )</td>
<td></td>
<td>0.240* (0.013)</td>
<td>0.018 (0.012)</td>
<td></td>
</tr>
<tr>
<td>( \text{fDExtc10}_i )</td>
<td></td>
<td>0.021 (0.013)</td>
<td>0.015 (0.012)</td>
<td></td>
</tr>
<tr>
<td>( \text{mRExtc10}_i )</td>
<td></td>
<td>0.023* (0.013)</td>
<td>0.017 (0.012)</td>
<td></td>
</tr>
<tr>
<td>( \text{fRExtc10}_i )</td>
<td></td>
<td>0.020 (0.013)</td>
<td>0.015 (0.012)</td>
<td></td>
</tr>
<tr>
<td>( \text{mDTExtc10}_i )</td>
<td></td>
<td></td>
<td>0.022* (0.011)</td>
<td></td>
</tr>
<tr>
<td>( \text{fDTExtc10}_i )</td>
<td></td>
<td></td>
<td>0.022* (0.012)</td>
<td></td>
</tr>
<tr>
<td><strong>Constant</strong></td>
<td>-4.549**(2.220)</td>
<td>-4.333* (2.269)</td>
<td>-3.576* (1.982)</td>
<td>-3.372* (2.013)</td>
</tr>
<tr>
<td><strong>Wald chi^2</strong></td>
<td>20.84</td>
<td>24.06</td>
<td>30.64</td>
<td>33.59</td>
</tr>
<tr>
<td><strong># obs</strong></td>
<td>212</td>
<td>212</td>
<td>272</td>
<td>272</td>
</tr>
</tbody>
</table>

*Note:* *, **, *** indicate statistical significance at 10%, 5% and 1%, respectively. Standard Errors in parentheses after coefficients.
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:

\[
200 \text{ experimental points} = 1\$ 
\]

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 on the same day or you can send someone else to pick up your cash payment on the same day). 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 or equal to 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.

<table>
<thead>
<tr>
<th>Bid Unit 1</th>
<th>Buyer 1</th>
<th>Buyer 2</th>
<th>Buyer 3</th>
<th>Buyer 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>135</td>
<td>135</td>
<td>140</td>
<td>145</td>
</tr>
<tr>
<td>Bid Unit 2</td>
<td>85</td>
<td>90</td>
<td>94</td>
<td>85</td>
</tr>
<tr>
<td>Bid Unit 3</td>
<td>80</td>
<td>0</td>
<td>80</td>
<td>40</td>
</tr>
</tbody>
</table>

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 or equal to the production cost of 70). All 10, and only the 10 units for which the bids were equal to 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 that you will bear a share of the additional costs even if you do not buy any units yourself.

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 that you will bear a share of the additional costs even if you do not buy any units yourself.

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

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**

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

In the example above, since the market quantity is 10 the additional costs per person are

\[(60/4)*10 = 150 \text{ points} = 0.75\].

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.
### History of Results by Period

<table>
<thead>
<tr>
<th>Period</th>
<th>Market Price</th>
<th>Market Quant</th>
<th>Number of Units YOU purchased</th>
<th>Your Gross Earnings</th>
<th>Your Final Earnings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practice</td>
<td>40</td>
<td>12</td>
<td>3</td>
<td>220</td>
<td>40</td>
</tr>
<tr>
<td>Practice</td>
<td>40</td>
<td>12</td>
<td>3</td>
<td>220</td>
<td>40</td>
</tr>
<tr>
<td>1</td>
<td>40</td>
<td>12</td>
<td>3</td>
<td>220</td>
<td>40</td>
</tr>
</tbody>
</table>

### Outcome of this Period

- Your bid for Unit 1: 40
- Your bid for Unit 2: 40
- Your bid for Unit 3: 40
- Your Gross Earnings: 220
- Total Additional Costs in your Group: 720
- Additional Costs per person: 180
- Your Final Earnings: 40

### Your Balance Today as of now

- Previous Balance: 0
- Final Earnings of this Period: 40
- Balance: 40

### Your Balance Next: Week

- Balance: 360
### History of Results by Period

<table>
<thead>
<tr>
<th>Period</th>
<th>Market Price</th>
<th>Market Quantity</th>
<th>Number of Units</th>
<th>Your Final Earnings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practice</td>
<td>40</td>
<td>12</td>
<td>3</td>
<td>220</td>
</tr>
<tr>
<td>Practice</td>
<td>40</td>
<td>12</td>
<td>3</td>
<td>220</td>
</tr>
<tr>
<td>1</td>
<td>40</td>
<td>12</td>
<td>3</td>
<td>220</td>
</tr>
</tbody>
</table>

### Outcome of this Period

- Your bid for Unit 1: 40
- Your bid for Unit 2: 40
- Your bid for Unit 3: 40

**Your Final Earnings:** 220

### Your Balance Today as of now

- Previous Balance (1): 0
- Final Earnings of this Period (2): 220
- Balance (1)+(2): 220

### Your Balance Next Week as of now

- Previous Balance (1): 3609
- Total Additional Costs in your Group: 720
- Additional Cost per person: 180
- Balance (1)-(2): 3429
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

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

(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.
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 or equals to 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 \(= 200 \text{ (resale value of unit 1) } - 60 \text{ (tax) } - 75 \text{ (market price) } = 65\). 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.

Suppose the tax proposal is rejected.

Trading will continue as before the vote and no changes will apply. Thus, in the above example, the seller will only accept bids above or equal to 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 or equal to 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 three 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.

Your task:

You will be given a list of messages. Your task is to evaluate whether each of the messages can be classified as expressing one of the following reasons: (you may assign more than one reason 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\(^{17}\).

- 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.

\(^{17}\) 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.\textsuperscript{18} 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.

\textsuperscript{18}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

<table>
<thead>
<tr>
<th>Classification Categories</th>
<th>Frequency (%)</th>
<th>I don’t like tax</th>
<th>I want to make more money</th>
<th>Preference for Default</th>
<th>Too difficult or confusing to understand the new rules/other</th>
<th>Number of messages with agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>“Yes” Voters</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Delay</td>
<td>0(0%)</td>
<td>35(89.7%)</td>
<td>0(0%)</td>
<td>4(10.3%)</td>
<td></td>
<td>45</td>
</tr>
<tr>
<td>Delay</td>
<td>1(5.3%)</td>
<td>16(84.2%)</td>
<td>0(0%)</td>
<td>2(10.3%)</td>
<td></td>
<td>21</td>
</tr>
<tr>
<td>Remove</td>
<td>2(14.3%)</td>
<td>11(78.6%)</td>
<td>0(0%)</td>
<td>1(7.1%)</td>
<td></td>
<td>17</td>
</tr>
<tr>
<td><strong>“No” Voters</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Delay</td>
<td>2(8.7%)</td>
<td>13(56.5%)</td>
<td>1(4.3%)</td>
<td>7(30.4%)</td>
<td></td>
<td>29</td>
</tr>
<tr>
<td>Delay</td>
<td>13(31.7%)</td>
<td>12(29.2%)</td>
<td>4(9.8%)</td>
<td>12(29.3%)</td>
<td></td>
<td>48</td>
</tr>
<tr>
<td>Remove</td>
<td>7(17.1%)</td>
<td>16(39.0%)</td>
<td>6(14.6%)</td>
<td>12(29.3%)</td>
<td></td>
<td>45</td>
</tr>
</tbody>
</table>
Table B.2b: Distribution of classification of the messages for the second question

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

\[ \pi_i = \sum_j d_{ij} \pi_{ij} - \sum_i \sum_j d_{ij} MEC_i \]  \hspace{1cm} (C.1.a)

where \( d_{ij} = 1 \) if the \( j^{th} \) unit is traded in this period and \( d_{ij} = 0 \) otherwise. \( \pi_{ij} \) 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:

\[ \pi_{i,\text{tax}} = \sum_j d_{ij} \pi_{ij} - \sum_i \sum_j d_{ij} MEC_i - \sum_j d_{ij} T + \frac{\sum_i \sum_j d_{ij} T}{n} \]
\[ = \sum_j d_{ij} \pi_{ij} - \sum_j d_{ij} T \]  \hspace{1cm} (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 \( \pi_{i,\text{tax}}^* = 70 \). 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:

\[ \pi_{it} = \sum_j d_{ij} \pi_{ij} - \beta \sum_{t=1}^{\gamma} \sum_i \sum_j d_{ij} MEC_i \]  \hspace{1cm} (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):

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

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:

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

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 \( \pi_{it,\text{tax}}^* = 190 - 120 \beta \gamma \).

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

Solving condition (C.2.d) 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.