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10610
2023

August 2023

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CESifo

Impressum:

CESifo Working Papers
ISSN 2364-1428 (electronic version)
Publisher and distributor: Munich Society for the Promotion of Economic Research - CESifo GmbH
The international platform of Ludwigs-Maximilians University's Center for Economic Studies and the ifo Institute
Poschingerstr. 5, 81679 Munich, Germany
Telephone +49 (0)89 2180-2740, Telefax +49 (0)89 2180-17845, email office@cesifo.de
Editor: Clemens Fuest
https://www.cesifo.org/en/wp
An electronic version of the paper may be downloaded
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CESifo *Working Paper No. 10610*

Can Policy Packaging Help Overcome Pigouvian Tax Aversion? A Lab Experiment on Combining Taxes and Subsidies

Abstract

Tax aversion makes it politically challenging to introduce Pigouvian taxes. One proposed solution to overcome this resistance is to package policies. Using an online lab experiment, we investigate whether combining a tax and a subsidy is perceived as more acceptable than the tax or the subsidy alone. The purpose of the policies is to reduce demand for a good with a negative externality to the socially optimal level. We find that support for a combination of a tax and a subsidy equals the simple average of support for the two instruments alone. Combining a tax and a subsidy therefore does not reduce tax aversion, other than through lower tax rates in the combinations. We also examine potential mechanisms behind the tax aversion. Participants hold more pessimistic beliefs about what share of the tax revenue they will receive when the tax is implemented alone than when it is combined with a subsidy. Furthermore, we find that the participants expect the tax to be more effective in reducing demand for the good with a negative externality than both the subsidy alone and the combinations of tax and subsidy. This belief does not, however, translate into support for the tax.

JEL-Codes: D720, H230, Q540, Q580.

Keywords: Pigouvian taxes, policy packaging, public support, lab experiment, tax aversion.

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August 30, 2023
This work was supported by the Research Council of Norway, grant number 308789. We would like to thank Frode Alfnes, Arild Angelsen, Kjetil Bjorvatn, Julie Brun Bjørkheim, Askill Harkjerr Halse, Karen Evelyn Hauge, Julia Del Carmen Naime Sanchez Henkel, Tora Knutsen, Andreas Kotsadam, Magnus Merkle, Marit Sandstad, Siv-Elisabeth Skjelbred, Håkon Sælen, and the rest of the research group KREM at the School of Economics and Business at NMBU for valuable input and comments.

1 Introduction

Pigouvian taxes are crucial policy instruments to cost-effectively reduce negative externalities such as emissions of greenhouse gases and other types of pollution, as they internalize the external costs (Timilsina, 2022). Shapiro and Metcalf (2023) find that not only do carbon taxes reduce emissions, they also induce firms to choose green technologies, and they find positive (but modest) effects on consumption, output and employment. However, public opposition towards Pigouvian taxes makes it challenging for policy makers to introduce them. The yellow vest protests against the fuel tax increase in France in 2018 is the iconic example of peoples' disapproval of carbon taxes (Douenne & Fabre, 2022). Another indication of the unpopularity and political difficulty of introducing taxes is that carbon pricing only covers 23% of global greenhouse gas emissions, with only 4% of emissions having a price sufficiently high to keep global warming below 2°C (The World Bank, 2022). The world's inability to correctly price externalities is tremendously costly: According to Parry et al. (2021), explicit and implicit global fossil fuel subsidies amounted to 6.8 percent of global GDP in 2020, mostly due to lack of environmental and other taxes.

It is therefore essential to explore policy designs or other interventions that can increase public support for Pigouvian taxes. One idea that has been garnering growing attention in multiple fields is to create policy packages (Givoni et al., 2013; Kern et al., 2019). Put simply, the idea is to combine effective but unpopular policies with less effective but more popular policies, to use secondary policies to offset undesirable impacts of the primary policies, or that the way the instruments work together is helpful.[1] In this paper we use a lab experiment to investigate how combining a tax with a subsidy influences the relative level of support.[2] We also examine the role of beliefs about the tax, the subsidy and the combinations of the two instruments to understand the low level of public support for taxes.

Economists have labelled the opposition against taxes "tax aversion". Tax aversion can be defined as opposition towards tax schemes that would increase both individual and social economic welfare, based on incorrect and pessimistic beliefs about the

[1] Ambec and Coria (2021) find that taxes reveal information about a firm's abatement costs and this information can be used to set an emission standard. Further, Acemoglu et al. (2012) find that a combination of a tax and a subsidy is optimal to target the interaction effects between environmental externalities and intertemporal knowledge externalities.

[2] Using both taxes and subsidies to target the same externality is a common practice. One example is a congestion tax on cars and a subsidy for public transport to target pollution from cars as well as congestion. Another is energy taxes combined with subsidies for investing in energy saving, such as improved insulation or installing heat pumps. Helm and Mier (2021) investigate the optimal mix of subsidies and taxes for intermittent renewable energy and energy storage. Combining taxes and subsidies to target a negative externality will probably not be as cost effective as having only taxes, see for instance Gugler et al. (2021).

properties of the tax such as its effectiveness and fairness.[3] Several of the factors shaping people's views about Pigouvian taxes are well established (Bergquist et al., 2022; Drews & Van den Bergh, 2016). From economic theory one would expect economic self-interest to play a central role. Whereas it does play a role, it cannot fully explain the opposition against Pigouvian taxes (Anderson et al., 2023; Dechezleprêtre et al., 2022; Douenne & Fabre, 2022; Heres et al., 2017; Kallbekken & Sælen, 2011; Umit & Schaffer, 2020). The belief that taxes do not reduce demand has consistently been shown to be one of the most important determinants of public opinion about taxes (Bergquist et al., 2022; Dechezleprêtre et al., 2022; Douenne & Fabre, 2022). Beliefs about fairness have also persistently been shown to be important (Dechezleprêtre et al., 2022; Douenne & Fabre, 2022).[4]

Research has identified some strategies that can be helpful for overcoming tax aversion. Earmarking of the tax revenue seems to increase support (Baranzini & Carattini, 2017; Dechezleprêtre et al., 2022; Kallbekken et al., 2011).[5] What the earmarked tax revenue is spent on can have strong impact on the level of support, but varies between groups of people (Anderson et al., 2023; Dechezleprêtre et al., 2022). Heres et al. (2017) find in a lab experiment that informing the participants that the tax revenue is returned in equal proportions to them, increases their support for taxes. However, the support for both a tax and a subsidy increases when there is no uncertainty about what happens to the income from the tax and the cost of funding the subsidy.[6] Allowing people to experience positive effects of an environmental tax, can increase support (Cherry et al., 2014; Schuitema et al., 2010; Winslott-Hiselius et al., 2009). The results on providing more information about how environmental taxes work are mixed (Dechezleprêtre et al., 2022; Douenne & Fabre, 2022; Kallbekken et al., 2011). Avoiding the term "tax" can under some circumstances lead to higher support (Baranzini & Carattini, 2017; Hardisty et al., 2010; Kallbekken et al., 2011).

A scarce literature explores the impact on the level of public support of combining coercive instruments like taxes with other and more popular policies. The interesting dynamic is how preferences for different types of policies interact when they are

[3]This combines and further develops the definitions of Kallbekken et al. (2011) and Douenne and Fabre (2022).

[4]Ideology or political attitudes can also be an important argument against taxes (Cherry et al., 2017). The view that the government should by principle not decide what one can and cannot do, could be a driver in the opposition against taxes. However, Douenne and Fabre (2022, p.83) find that "these results suggest that the rejection of carbon taxation does not typically result from clashing principles, such as a disinterest in the climate or a dislike of price instruments, but rather from overly pessimistic beliefs about the properties of the reform."

[5]We do not define earmarking of tax revenue to a specific purpose as a policy package or policy bundle. To be defined as a policy package, different instruments have to be combined.

[6]From the research design in Heres et al. (2017), we cannot disentangle whether the increased support comes from the removal of the uncertainty or that the tax revenue is shared between the participants, or both.

combined. Is, for instance, the joint assessment of combined instruments (policy packages) dominated by the instrument the respondents are most (or least) averse to, or is it a simple averaging of the preferences for each instrument?

The early contribution by Eriksson et al. (2008) finds that support for a combination of two instruments is higher than for the most restrictive instrument alone, but the level of support is lower than the average of support for the two constituent parts (a fossil fuel tax combined with either improved public transport or subsidies for renewable fuels). However, when the instruments are presented in isolation, it appears that no information is provided on how the tax revenues are to be spent or how the subsidies are to be financed, whereas this information is provided for the two policy packages.

Two more recent and experimental papers indicate a positive dynamic: Milkman et al. (2012) find that bundled policies are valued more highly than the most popular policy is valued on its own.[7] The policies vary in their costs and benefits (jobs lost, acres of forest protected, etc.), and hence the results are somewhat difficult to interpret. Using a choice experiment, Fesenfeld (2022) finds that bundling policies may reduce opposition to taxation. He studies the impact of policy complexity by comparing responses to low complexity policy proposals (one goal and one instrument) with high complexity policy proposals (one goal and four policy instruments). When a large tax increase is added to a low complexity policy proposal, he finds that it decreases the probability of choosing that package (the average marginal component effect) by 15 and 27 percentage points among German and US respondents, respectively. However, when the same large tax increase is added to a high complexity policy proposal, it decreases the probability of choosing that policy package by only 9 and 18 percentage points, respectively. In this choice experiment, payoffs and policy effectiveness are not made explicit, but the subsidies offer lower consumer prices (for food and transport) at no explicit cost.

The existing literature does not disentangle the mechanisms that can explain how a joint preference for combined instruments is formed: Instrument type varies together with costs and benefits, and these studies are therefore unable to pinpoint what causes the level of support for the combination to differ from the level of support for the constituent parts. Based on the diverging previous findings, we explore the dynamics of how the preferences for a tax and a subsidy interact to form the preference for a combination of the two in a setting where 1) participants' decisions are incentivized, 2) the study is sufficiently powered to detect a 6 percentage point difference in support

[7] In the article they write that "bundled legislation is valued more than the sum of its parts", but the correct wording seems to be "higher than the most popular policy on its own". For example, Bill 1 and Bill 2 has 54% and 45% support, respectively, while the combined Bill has 83% support.

for policies (see pre-analysis plan (p.7) in Appendix D for details), 3) payoffs are equal across instruments (for the same behaviour), and 4) the combinations of instruments are fractional rather than additive. This means that when the tax and subsidy are combined, the tax and subsidy rates are lower than when the tax or the subsidy are implemented alone.

Further, we want to investigate the mechanisms behind the lack of support for taxes by comparing beliefs about a tax with beliefs about a subsidy and combinations of the two. Expectations about the effectiveness of the instrument in reducing the externality and about what happens with the tax revenue and the subsidy cost are interesting to shed light on in order to deepen our understanding of attitudes towards Pigouvian taxes.

In our experiment we introduce a market for a fictitious good with a negative externality where participants earn a financial reward (payoff) through the profit they make by purchasing units of the good. At the same time they are negatively affected by the externality from the units purchased by the other participants in their group. Participants vote on the introduction of policies that can incentivize participants to purchase the socially optimal number of units through a tax, a subsidy, or combinations of the two instruments. If implemented, the tax is charged for any units purchased, whereas the subsidy is paid for any of the units *not* purchased. The participants are randomized into five different groups: (1) 100% tax, (2) 75% tax & 25% subsidy, (3) 50% tax & 50% subsidy, (4) 25% tax & 75% subsidy, and (5) 100% subsidy.

Taxes have two core properties: First, they change the price the consumer faces so that demand decreases (as long as demand is not fully inelastic), which in turn reduces the external costs. Second, they generate revenue that can be spent by the government, such as distributing it back to the citizens. Subsidies also change the (direct or implicit) price the consumer faces, but instead of generating income for the government, subsidies need to be financed. If the tax is implemented in our lab experiment, the revenue collected from each participant is split equally between the other group members. We do not include the revenue from the participant itself to mimic the real world setting where the revenue from the tax paid by the participant itself is a marginal contribution to the total tax revenue.[8] The subsidy payments received by each participant are financed through equal contributions from the other group members. In this way we ensure that all policies in the experiment produce identical payoffs for the same behaviour for all group members. However, we cannot verify whether the participants actually take this payoff into account when they vote.

[8] As each group in our experiment consists of three members, $\frac{1}{3}$ is a large part of the total tax revenue, while in the real world the "group" typically consists of millions of people.

The first contribution of this paper is that we find that the point estimates of the public support increases linearly as the subsidy share increases and the tax share decreases in the fractional combinations of the instruments. As explained above, this is in a setting where decisions are incentivized and the payoff structures are identical across policies. Our experiment with 1641 participants thus produces results that do not align with the previous findings of Milkman et al. (2012) and Fesenfeld (2022).[9] The dynamics we observe indicate no beneficial effect on public support from combining policy instruments beyond the simple averaging of preferences for the constituent parts of the package. Thus, the increased support found in Milkman et al. (2012) might have come from the increased gain in the policy package and not from the strategy of packaging as such.

The second contribution of this paper is that we find pessimistic beliefs about what happens to the tax revenue. This finding is consistent with Douenne and Fabre (2022, p.83), who find that the opposition against the carbon tax comes "from overly pessimistic beliefs about the properties of the [carbon tax] reform." Revealing pessimistic beliefs in different contexts is important for understanding the opposition towards Pigouvian taxes. We find more pessimistic beliefs about what share of the tax revenues the participants in the experiment will receive (a piece of information that is not clearly shared with them initially, cf. Section 2) when a tax is the only policy, than when it is combined with a subsidy. Similarly, the beliefs about whether the proposed policy will increase the payoff compared with no policy are more pessimistic when the tax is the only instrument than when the tax is combined with a subsidy or the subsidy alone. Furthermore, for the combination of a tax and a subsidy, the share expecting the policy to increase the payoff declines with the share of the tax in the proposed policy. Participants do expect to pay a substantial share of the subsidy cost, but unlike the expectations about tax revenues this share does not differ significantly across treatments. Because our design has fractional combinations of the tax and the subsidy, we can investigate what happens with a gradual decrease of the tax share of the instrument. The result shows that the pessimistic beliefs about the tax revenue are specific to the 100% tax treatment group.

The third contribution is that we find that participants expect the tax to be more effective in reducing the demand for the good causing the externality than the subsidy alone and the combinations of a tax and a subsidy. This contradicts previous findings that people believe taxes not to be effective in reducing demand, which has been found to be one of the main reasons why people oppose taxes (Bergquist et al., 2022;

[9] Milkman et al. (2012) had far fewer participants (168), while Fesenfeld (2022) had 9115 participants.

Douenne & Fabre, 2022).[10] We do not simply ask the participants whether they expect the policy to be effective. Instead we ask how many units they expect the other participants in their group to buy with and without the policy. The expectation about the effectiveness of the tax does not translate into support for the tax. By contrast, in the subsidy treatment, almost all who expect the policy to be effective also vote for the policy.

In the next section, we describe our experimental design, the theoretical predictions of what the participants will do, the experimental procedure, the sample and the balance tests. Then we analyse the findings, before the we discuss and conclude. We posted a pre-analysis plan on AEA Social Registry before the experiment started with RCT ID AEARCTR-0009099 and this can be found in Appendix D. Deviations from the plan are mentioned in the text and elaborated in Appendix E.

2 Methods

2.1 Experimental design

The experiment consists of a market round, a policy vote and then a second market round. In the market, participants decide how many units of a good to buy. Buying the good creates value for the participants, but also an external cost that is imposed on the others in their group. In the first round there is no policy. Participants are then asked to vote on a policy proposal that would incentivize all to limit the number of units bought to the social optimum. If the majority votes for the policy, the prices and the payoff structure in the second market round changes. The outcome we are interested in is whether the participants vote yes or no to the policy proposal. The experimental design is based on Kallbekken et al. (2011), Cherry et al. (2013), Cherry et al. (2014), Heres et al. (2017) and Cherry et al. (2017).

Each participant is part of a group with two other participants. All the participants act as buyers in a market. Each participant can buy up to six units of the good. The price of each good is 40 tokens,[11] whereas the value of each of the units of the goods differ. The first unit has the highest value and then each additional unit is worth less, mimicking declining marginal utility of consumption, see Table 1. For each unit a buyer in the group purchases, a cost of 20 tokens is imposed on each of the two other members of the group, meaning that the total external cost per unit is 40 tokens.

In the first round, the payoff is calculated as the value of the units each participant

[10] Dechezleprêtre et al. (2022) also find that the majority of the respondents believe that a carbon tax would result in less driving.

[11] The currency used in the experiment is tokens, where 100 tokens equal £1.

Table 1: The value of each unit the participants can buy.

Number	Value of the unit
1.	130
2.	110
3.	90
4.	70
5.	50
6.	30

buys minus the price of the units and minus the external costs from the purchases by the two other group members, see Table 2. At the end of the round, participants receive feedback on all the components of this payoff equation.

Table 2: Example of how the payoff is calculated in round 1. The example is based on all group members choosing five units.

	Element in the payoff	Example
	The value of the units the participant buys	130+110+90+70+50= 450
-	the price of the units	- 40*5 = -200
-	the external costs from the purchase by the others in the group	-20*5*2= -200
=	Payoff	50

In order to reduce strategic behavior within the group, the participants only have one round to get to know the market before they vote on a policy proposal. Further, we decided to nudge the participants into choosing five units (the dominant strategy, see Section 2.2) in the first round by informing them (truthfully) that in a pilot we ran for the experiment, a majority chose five units.

After experiencing this market for one round, participants are asked to vote on the rules that will govern the next round of the market. These rules vary across treatment groups. The participants' choices are to either 1) keep the rules as they were for the previous round, or 2) introduce a new specific policy.

The specific policy can either be a tax, a subsidy, or a fractional combination of the two. The option that receives the majority of votes (i.e., policy or no policy) will be implemented. Whether or not a participant votes for the proposed policy is the outcome variable. This a between-subjects design where participants are randomly allocated to one of five treatments. The five treatments are:

1. 100% tax: A tax of 40 tokens per unit.

2. 75% tax & 25% subsidy: A tax of 30 tokens per unit and a subsidy of 10 tokens per unit not purchased.[12]

[12]To give subsidies for not buying or producing something is e.g. done within farming and

3. 50% tax & 50% subsidy: A tax of 20 tokens per unit and a subsidy of 20 tokens per unit not purchased.

4. 25% tax & 75% subsidy: A tax of 10 tokens per unit and a subsidy of 30 tokens per unit not purchased.

5. 100% subsidy: A subsidy of 40 tokens per unit not purchased.

As all policies entail the same monetary payoff for choosing the dominant strategy (see Section 2.2), what differs is how the payoff structure is implemented (via a tax or a subsidy), and for simplicity of exposition we will refer to this difference as the "tax share" of the proposal (i.e. 100, 75, 50, 25 or 0% tax). Whereas previous studies add policies to the policy package, our design using fractional combinations of two policies (tax and subsidy) is essential for keeping monetary payoffs for choosing the dominant strategy identical across treatments.

We inform the participants that the value of each unit will remain the same if policy is implemented, and what the new price per unit will be if the tax is implemented (50 to 80 tokens depending on the treatment). For the subsidy, the price per unit remains the same, but the value of each unit is reduced since the participants receive money for each unit they do not buy.

The payoff is calculated in the same way as in the first round, but the price of the good changes. In addition, in the four treatment groups where there is a subsidy, the subsidy paid for not buying a good is also added to the payoff. Further, the tax revenue is distributed and the subsidy cost is financed. The revenue from the tax a participant in the group pays is shared equally among the two other participants. The cost of the subsidy a participant in the group receives is shared equally among the two other participants. The participants are, however, not informed fully about how the tax revenues or the cost of the subsidy will be shared among the three group members (see the next paragraph). Table 3 shows an example of payoff calculation in the second round. If someone has a negative payoff at the end of the experiment, the payoff is 0.

When voting for policy or no policy, the participants are by design not fully informed about how the tax revenues will be distributed nor how the subsidy will be financed. This is the same design as in Heres et al. (2017). This resembles real world situations where tax revenue use and subsidy funding are rarely explicit. To avoid deception, we provided the following information before participants were asked to vote: "The tax generates revenue. The group's budget will be balanced through personal transfers

foresting. For instance, the subsidy scheme REDD+ is paying for not deforesting forests. Another example is to subsidize no-till farming.

Table 3: How the payoff is calculated in round 2. The example is based on all group members choosing three units and that the policy with 50% tax & 50% subsidy is implemented.

	Element in the payoff	Example
	The value of the units the participant buys	130+110+90= 330
-	the price of the units	- 60*3 = -180
+	the subsidy for the units not bought	+ 20*3 = 60
-	the external costs from the purchase by the two other participants	-20*3*2= -120
+	the income from the tax from the two others in the group	+10*3*2=120
-	the cost of the subsidies to the two others in the group	-10*3*2=-120
=	Payoff	90

of tokens between the members of the group."[13] After the votes have been cast and the number of units chosen, we inform participants about the distribution of the tax revenues and the financing of the subsidy payments.

After the vote, but before participants decide how many units to purchase, we elicit expectations in order to help uncover the mechanisms behind their voting decision. First we ask how many units they expect the other members in the group to buy with and without the policy implemented. Second, we ask what share of the tax revenue from the other group members the participant expects to receive, and/or what share of the subsidy cost for the other group members the participant expects to pay (depending on the treatment they are in). Finally, we ask whether the participant expects their payoff to increase, decrease or remain the same if the policy is implemented.

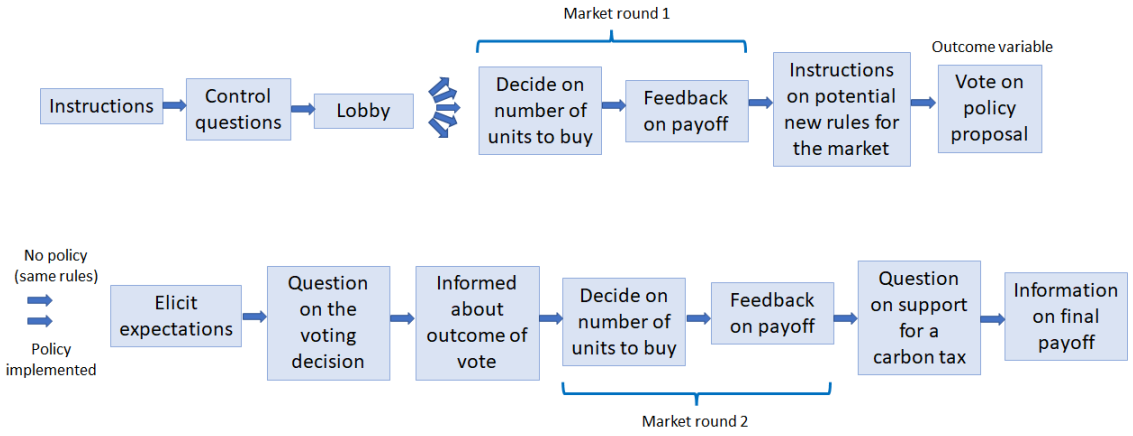
After the purchasing decsions are made in the second round, participants are asked: "Imagine that to combat climate change the government proposed to increase the cost of emitting CO_2 by £100 per ton from next year. This would increase the cost of petrol by 23 pence per litre and diesel by 26 pence per litre. If there was a vote on this tax proposal today, what would you have voted?" This question is to test whether voting for the tax in the experiment is correlated with expressing a willingness to vote for a hypothetical CO_2 tax.

Figure 1 shows a timeline of the experiment. Screenshots of each page the participants see are found in Appendix G.

One factor which has been found to be important for the level of support for Pigouvian taxes is distributional effects (see for instance Andor et al. (2022) and Dechezleprêtre et al. (2022)). We wanted to investigate other factors important for attitudes towards

[13]For the subsidy treatment we write: "The subsidy costs money. Your group's budget will be balanced through personal transfers of tokens between the members of your group." For the three combinations we write: "The tax generates revenue and the subsidy costs money. Your group's budget will be balanced through personal transfers of tokens between the members of your group."

Figure 1: The timeline of the experiment.



taxes and subsidies, and therefore we have designed an experiment in which there are no distributional effects (for the same behaviour). We keep the endowment and payoff structure identical for all participants within each group.

2.2 Theoretical predictions

For the individual participant, buying five units maximizes own payoff in the first round of the experiment, irrespective of how many units the other participants buy. We refer to this choice as the dominant strategy.[14] The socially optimal number of units to purchase is, however, three per participant.

The social optimum represents an efficiency gain over the market equilibrium if participants choose the dominant strategy. Total group payoff then increases from 150 to 270 tokens. By reducing their purchases by a total of 6 units (2 units per person), the buyers forego profits of 120 tokens, but external costs are reduced by 240 tokens, yielding a net gain of 120 tokens.

If the policy is implemented, the payoff structure changes, and the dominant strategy will be to choose three units, i.e., the socially optimal choice. If all participants choose the dominant strategy, introducing the policy increases the individual payoff from 50 tokens to 90 tokens. This payoff is the same for all policies, given that all group members follow the dominant strategy.

If the whole group chooses three units (the socially optimal number) in the first round, their individual payoff increases from 50 to 90 tokens. This is the same payoff

[14]When taking into account how choices in the first round may influence voting and the choice in the second round, it is not obvious that this is a dominant strategy. However, as we only had one round before the vote, choosing five units in the first round would most likely maximize final payoff, too.

as when any of the considered policies are implemented, assuming participants follow their new dominant strategy. Hence, one could argue that there is no incentive to vote for a policy if all three participants choose three units. However, there is no guarantee that the other participants will continue choosing three units in the second round if a policy is *not* implemented, as the dominant strategy in the absence of a policy is to choose five units. With a policy implemented, the dominant strategy is always to choose three units.[15]

2.3 Experimental procedures

We conducted an online interactive experiment on November 24th 2022, using the software Lioness lab (Giamattei et al., 2020). The participants were recruited from the online platform Prolific, a United Kingdom based firm that recruits participants for research.

Each participant is guaranteed to earn £1.5 if completing the experiment, in addition to the payoff. The median time to complete was just below 15 minutes, which means that the guaranteed payment equalled £6 per hour on average. The average payoff was £1.16, which is added to the guaranteed earnings. The payoff is based on the choices the participants make in the experiment, as explained in Section 2.1. The total average payment was thus almost £11 per hour.

All interactions are anonymous. Before the participants can enter the experiment, they receive instructions and have to correctly answer three control questions to test that they understand the rules.

Participants are assigned to a treatment group depending on the order in which they enter into the experiment after answering the control questions correctly. The first three participants entering get treatment 1, the next three participants entering get treatment 2 and so on. As several hundred participants take part simultaneously, and assignment to groups happens sequentially, the allocation to treatments is random.

2.4 The sample

The sample consists of 1641 participants, all of them UK residents. Table 4 shows the number of observations in each of the five treatment groups. Table 5 displays the observational characteristics of the participants.

Table 4: Number of observations in each treatment group.

Treatment group	Number of observations
Tax	331
75% tax and 25% subsidy	323
50% tax and 50% subsidy	325
25% tax and 75% subsidy	328
Subsidy	334
Total	1641

Table 5: Descriptive statistics of the participants.

Characteristics	Average/Share	Number of observations
Age	38.4	1619
Female	50.0%	1579
Student status	11.4%	1641
Full-time employed	47.2%	1619
Part-time employed	15.7%	1619
Unemployed	4.6%	1619
Country of birth United Kingdom	80.2%	1641
Ethnicity white	83.2%	1619
Nationality United Kingdom	86.5%	1619
Language English	88.0%	1619

Notes: Some participants have missing values on some variables and therefore the total number of observations are not 1641 for all variables.

Table 6: Balance tests

Treatment group	Age	Diff tax	t-statistics
Tax	39.4	–	–
75% tax and 25% subsidy	39.2	-0.2	0.14
50% tax and 50% subsidy	37.1	-2.3	2.14
25% tax and 75% subsidy	37.6	-1.8	1.70
Subsidy	38.8	-0.6	0.57
Treatment group	Share of females	Diff tax	t-statistics
Tax	53.0%	–	–
75% tax and 25% subsidy	46.8%	-6.2	1.56
50% tax and 50% subsidy	48.7%	-4.3	1.07
25% tax and 75% subsidy	50.3%	-2.7	0.67
Subsidy	51.2%	-1.7	0.44
Treatment group	Chose 5 units in part 1	Diff tax	t-statistics
Tax	54.4%	–	–
75% tax and 25% subsidy	57.9%	3.5	0.90
50% tax and 50% subsidy	59.1%	4.7	1.21
25% tax and 75% subsidy	54.3%	-0.1	0.03
Subsidy	57.2%	2.9	0.73

2.5 Balance tests

We test whether the other treatment groups differ from the tax group (which we use as the "control" group) for the variables age and gender, in accordance with the pre-analysis plan. We also check whether the choices in part 1 of the experiment are balanced across treatments.

Table 6 shows that for two of the treatment groups the average age is around 2 years younger than in the tax group. This is statistically significant, but it is not a large difference, and therefore we do not see it as a cause for concern. We check whether the age variable interacted with the treatment groups is statistically significant, see Table A-6. The coefficient is significant for the 50% tax & 50% subsidy treatment group interacted with age, but the size of the coefficient is only -0.005. For the other treatment groups the interaction term is not statistically significant.

For gender there are no statistically significant differences between the tax treatment group and the other treatment groups. In addition, there is balance between the treatment groups on the share of people choosing five units (the dominant strategy, see Section 2.2) in the first part.

We also test whether the treatment groups are different from each other, for instance if the 100% subsidy group is different from the 25% tax & 75% subsidy group on both age and gender. They are not statistically different, see Table A-1 in Appendix A.

3 Results

In this section we present the purchases the participants make, individual payoffs, voting results, expectations about the policies, and the result of the test for external relevance.

We analyse the results from the experiment using an OLS regression as generally recommended by Duflo et al. (2007). OLS coefficients are intuitive to interpret. As long as the probability is not close to 0 or 1, using OLS in combination with a binary outcome variable is regarded as unproblematic (Stock & Watson, 2015).

3.1 Purchases and individual payoffs

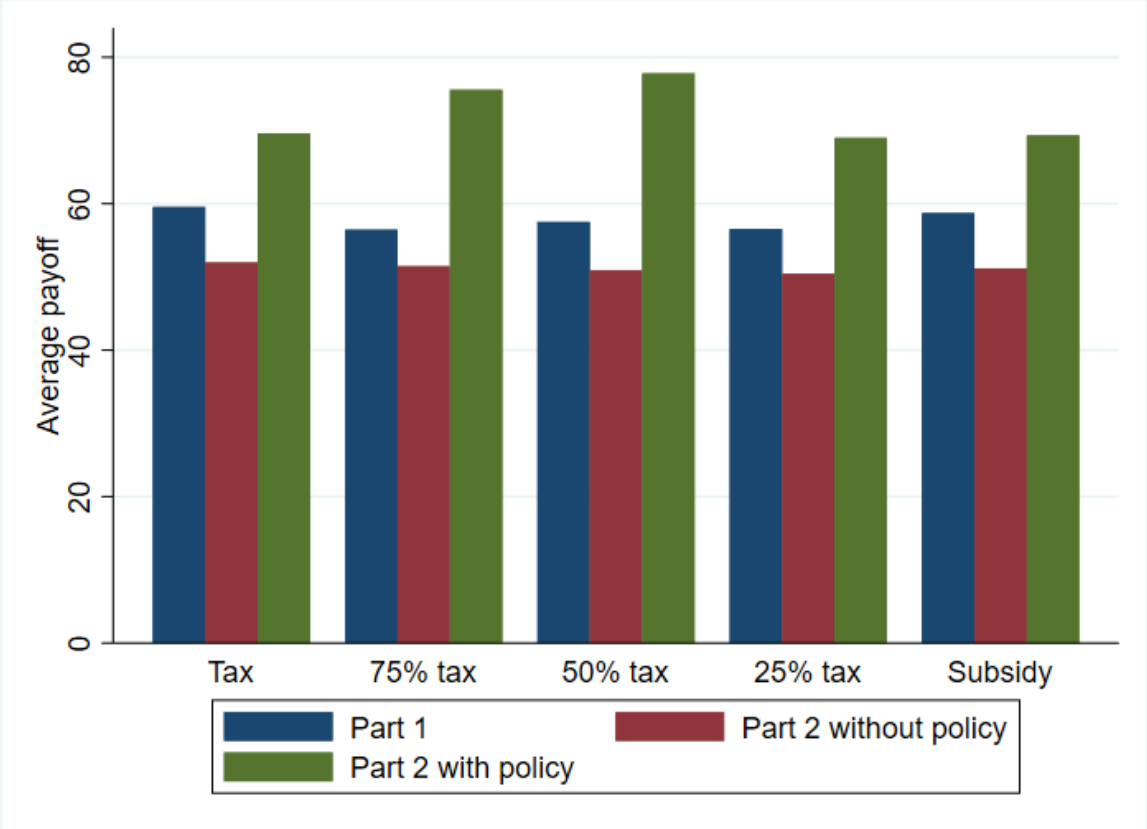
Participants on average buy 4.6 units in the first part, 3.5 units in the second part when a policy is implemented and 4.8 units in the second part when no policy is implemented. See Figure A-1 in Appendix A for the average number of units by

[15] In the experiment, a majority of the participants chose five units in the first round, and the share of participants choosing five units is balanced across the five treatment groups (see Table 6).

treatment. This means that the policies reduced the demand significantly, although less than the theoretical predictions, of the good with a negative externality.

On average across treatments, only 36.2% of the participants voted for the policy, meaning that 63.8% voted to keep the rules as they were. The average individual payoff is higher with policy than without, see Figure 2. However, the payoff in part 1 is higher than the theoretically predicted payoff (i.e., if participants choose their dominant strategy), and lower than the predicted amount in part 2 with policy (see Section 2.2).

Figure 2: The average individual payoff for the different groups in part 1 and part 2 with and without policy.



Notes: The 75% tax group also has 25% subsidy. The 50% tax group also has 50% subsidy. The 25% tax group also has 75% subsidy.

3.2 Support of the policy

We now turn to the main result of the experiment. The outcome variable is whether or not a participant votes for the proposed policy. We test whether there is a difference in the level of support between tax, subsidy and combinations of tax and subsidy. We estimate the following regression equation:

$$v_i = \beta_0 + \beta_1 c3_i + \beta_2 c4_i + \beta_3 c5_i + \beta_4 s_i + u_i \quad (1)$$

v_i is a binary variable for whether the person voted for the policy or not, $c3_i - c5_i$ are binary variables for whether the participant is in the treatment group with respectively 75% tax & 25% subsidy, 50% tax & 50% subsidy, and 25% tax & 75% subsidy, and s_i is a binary variable for being in the treatment group with 100% subsidy.

Table 7: Testing the difference in support for policy between the treatment groups.

	(1) Vote
Subsidy	0.388***
	(0.0339)
25% tax and 75% subsidy	0.322***
	(0.0341)
50% tax and 50% subsidy	0.206***
	(0.0334)
75% tax and 25% subsidy	0.106**
	(0.0317)
Constant	0.157***
	(0.0200)
Observations	1641
R^2	0.086

Tax treatment group is the baseline.
Robust standard errors in parentheses.
*$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

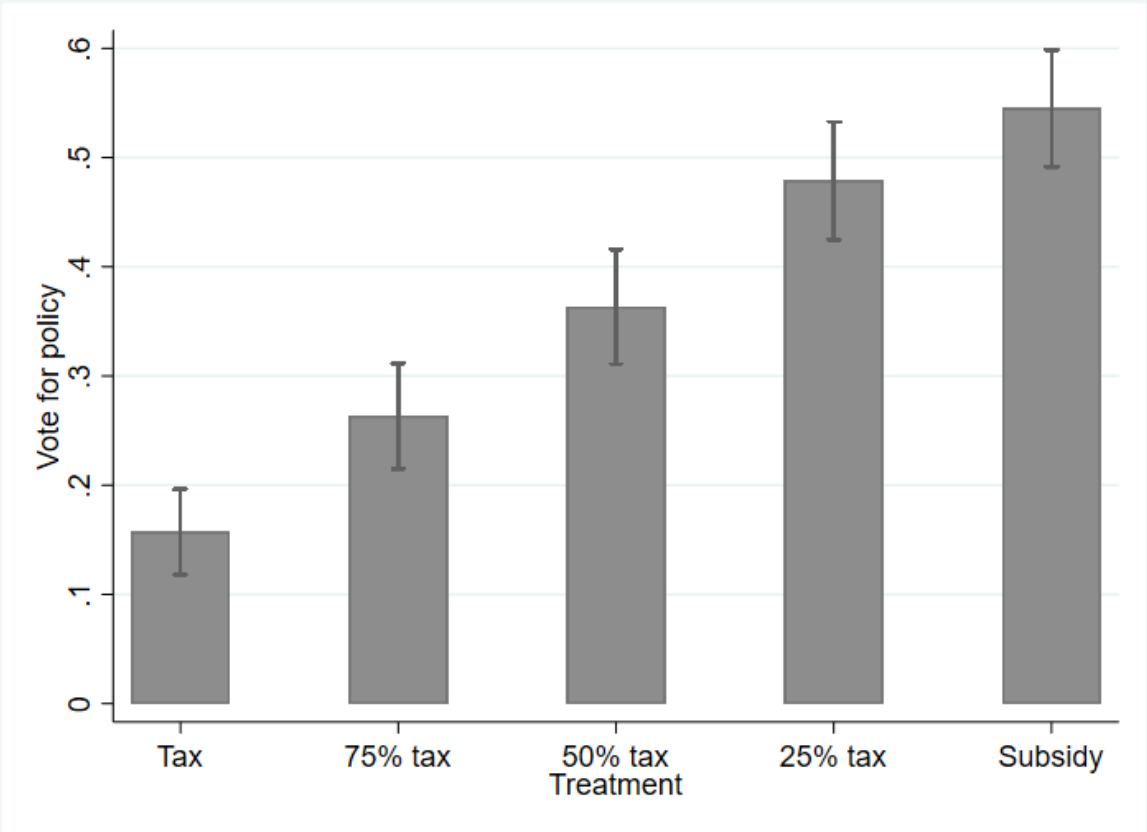
The tax treatment group is the baseline, and all coefficients are compared to the level of support in the 100% tax treatment. The H_0-hypothesis (no difference between the treatment groups) is rejected, see Table 7.[16] We find that the support for policy increases with the subsidy share in the policy proposal.

Figure 3 shows the share of participants voting for the policy proposal by treatment. This illustrates visually what the coefficients of the regression analyses show: Support increases approximately linearly with the share of the subsidy in the policy proposal. The effect of combining policy instruments is, in our experiment, close to a perfectly linear combination of the support for a tax alone and a subsidy alone.

Before the experiment was conducted, our hypothesis was that the support for the combinations of instruments would be somewhere between the support for the tax alone and the subsidy alone (see p. 4-5 in the pre-analysisplan in Appendix D). We

[16]To adjust for the fact that we test several hypotheses, we follow Fink et al. (2014) and use Benjamin - Hochberg adjusted p-values. This can be seen in Appendix C.

Figure 3: The share voting for the policy in each treatment group.



Notes: The 75% tax group also has 25% subsidy. The 50% tax group also has 50% subsidy. The 25% tax group also has 75% subsidy. The lines are 95% confidence intervals.

did not have an a priori belief about whether the support would be different between having a 25% tax & 75% subsidy, 50% tax & 75% tax or a 75% tax & 25% subsidy. What we find is a clear difference in support between the combinations and that the support for the policy is increasing in the subsidy share. Further, both the support for policy of the 50% tax & 50% subsidy and the 75% tax & 25% subsidy groups are statistically significantly different from both the 100% tax and the 100% subsidy group.

3.3 Expectations about the policy

We elicited four different expectations about consequences of the policy proposals. We use these to investigate mechanisms that can potentially explain why participants voted for or against the policy proposals.[17] We first test whether the treatment groups differ in their expectations about how the policy work. Then we test whether the support for the policy differs between the treatment groups among those that hold the specific expectation and those that do not. At the end of the section, we do an exploratory analysis where we simulate the expected payoff based on the answers the participants gave.

3.3.1 Mechanisms: Expectations about the effect of the policy

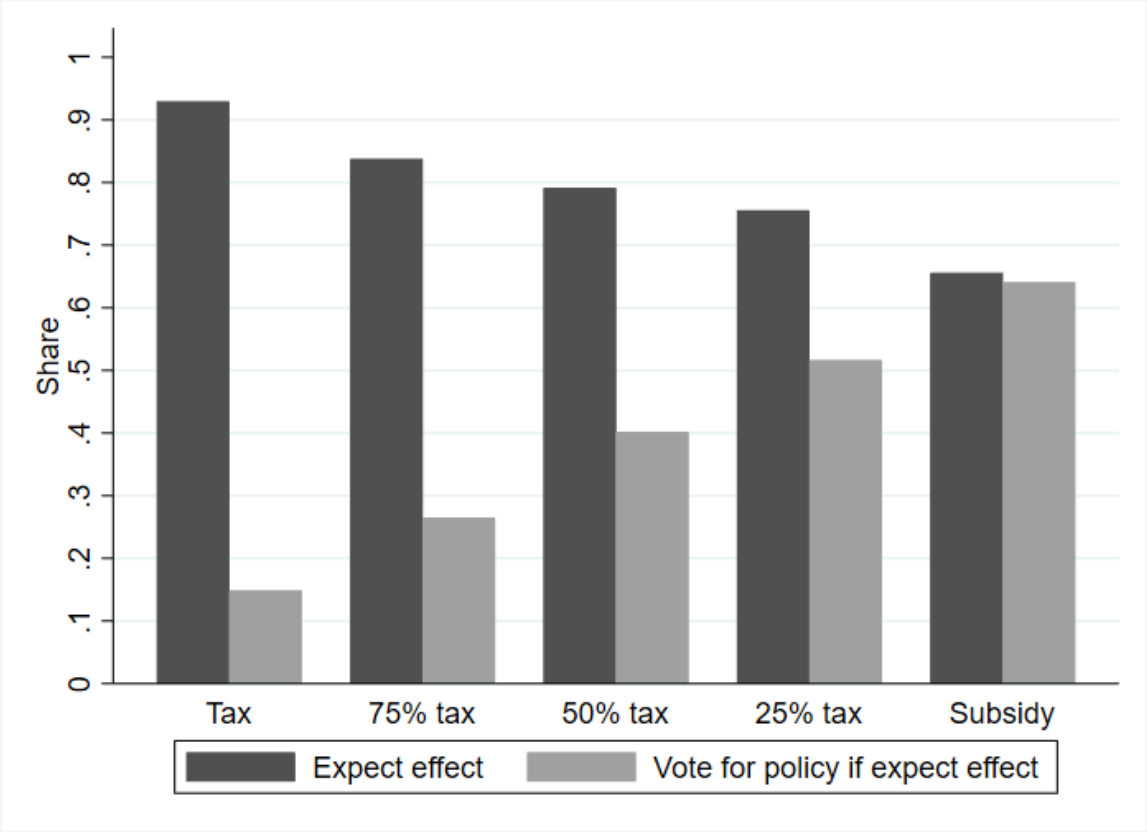
To what extent participants expect the policy to reduce the demand differs across treatments. Results are shown in Figure 4 and Table A-2, column 1. In the tax treatment group, 93% of participants expect a reduction in demand. In the subsidy group, 27 percentage points fewer (66%) expect a reduction in demand. In the combination treatments, expectations are in between those for the tax and subsidy treatments, and are all statistically different from the tax group.[18] This indicates that the type of policy instrument influences expectations about policy effectiveness. Keep in mind that the experiment is designed so that all policies provide the same incentives and should be equally effective in reducing demand.

Further, Figure 4 and Table A-2, column 2 shows that the probability of voting for the policy among those who expect the policy to reduce demand increases with the share of subsidies in the policy proposal. Those who expect the subsidy to reduce

[17] There is a slight deviation from the pre-analysis plan, see Appendix D. We have reformulated the regression equations. This is done to obtain a more relevant comparison group when testing whether the difference is statistically significant. The topics we test follow the pre-analysis plan, and all are included. The reformulation of the regression equation follows the same pattern for all topics. This is explained in detail in Appendix D. The results from the regression equation in the pre-analysis plan can be seen in Appendix F.

[18] The 50% tax & 50% subsidy group is not significantly different from neither the 25% tax & 75% subsidy group nor the 75% tax & 25% subsidy group. The 25% tax & 75% subsidy group and 75% tax & 25% subsidy group are statistically different from each other (tests not shown).

Figure 4: The share expecting effect in each treatment group and the share voting for policy if they expect an effect.



Notes: The 75% tax group also has 25% subsidy. The 50% tax group also has 50% subsidy. The 25% tax group also has 75% subsidy. The voting of those that do not expect an effect can be seen in Table A-2.

demand have a 49 percentage points higher probability of voting for the policy, than those who expect the tax to reduce demand. The results for the treatments with combinations of tax and subsidy lie in between the levels for the tax and subsidy treatments. The higher the tax share in the proposal, the higher the share of people expecting the policy to be effective, but also the lower the support for the policy. This indicates that expectations about effectiveness is not what drives policy support in our experiment.

For those that do not expect an effect, there is no statistically significant difference between the tax treatment group and the other treatment groups, see Table A-2, column 3.

3.3.2 Mechanisms: Expectations about the tax revenue

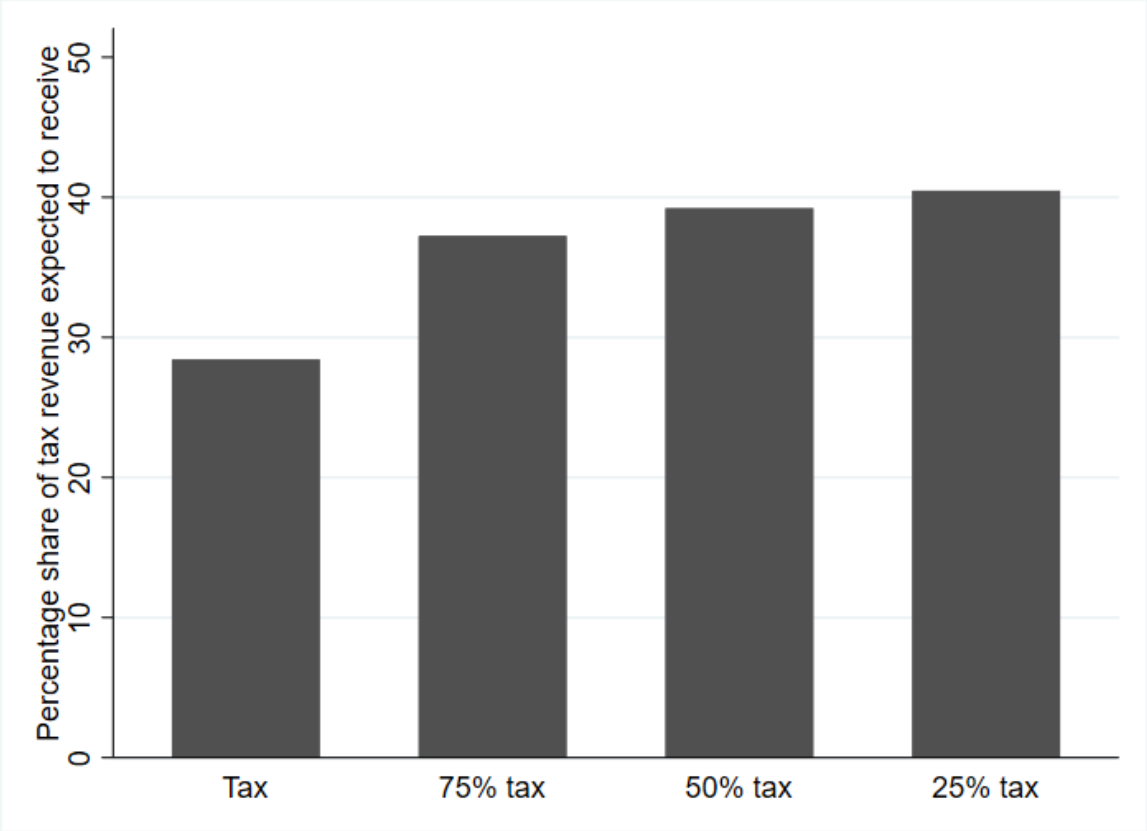
Participants in the combination treatments expect to receive a higher share of the tax revenues than those in the 100% tax treatment, see Figure 5 and Table A-3, column 1. The difference in expected share of revenues is not statistically different between the three combination treatments, but the combination treatments are all significantly different from the 100% tax treatment group. The experimental design and instructions should not give participants any reason to hold different expectations regarding the share of revenues shared across the tax and combination treatments. This shows pessimistic beliefs about how the tax works when it is implemented alone, compared to when the tax is combined with subsidies.

In addition, the share of voting for the policy among those who expect to receive a share of the revenue is increasing with the subsidy share in the policy proposal, from 48% voting for policy in the 25% tax & 75% subsidy treatment group to 18% voting for the policy in the 100% tax treatment (see Table A-3, column 2 and Figure A-2).

For those that do not expect to receive a share of the tax revenue, the combination treatment groups have a higher voting share for the policy than the 100% tax treatment groups, but the voting pattern is not linear (see Table A-3, column 3 and Figure A-2).

Asking participants what share of the revenue they expect to receive might induce some people who otherwise would not consider that they might receive any of the tax revenue, to believe that they may do so. As a starting point, we placed the slider handle they use to indicate share of revenues they expect to receive in the middle (50%). This could influence participants to keep the slider closer to the middle than they would otherwise have done. However, asking this question cannot influence voting as it is asked after the votes have been cast. This caveat applies equally to all treatment groups, so even if the point estimates might be influenced by the starting

Figure 5: The share of the tax revenue expected to receive.

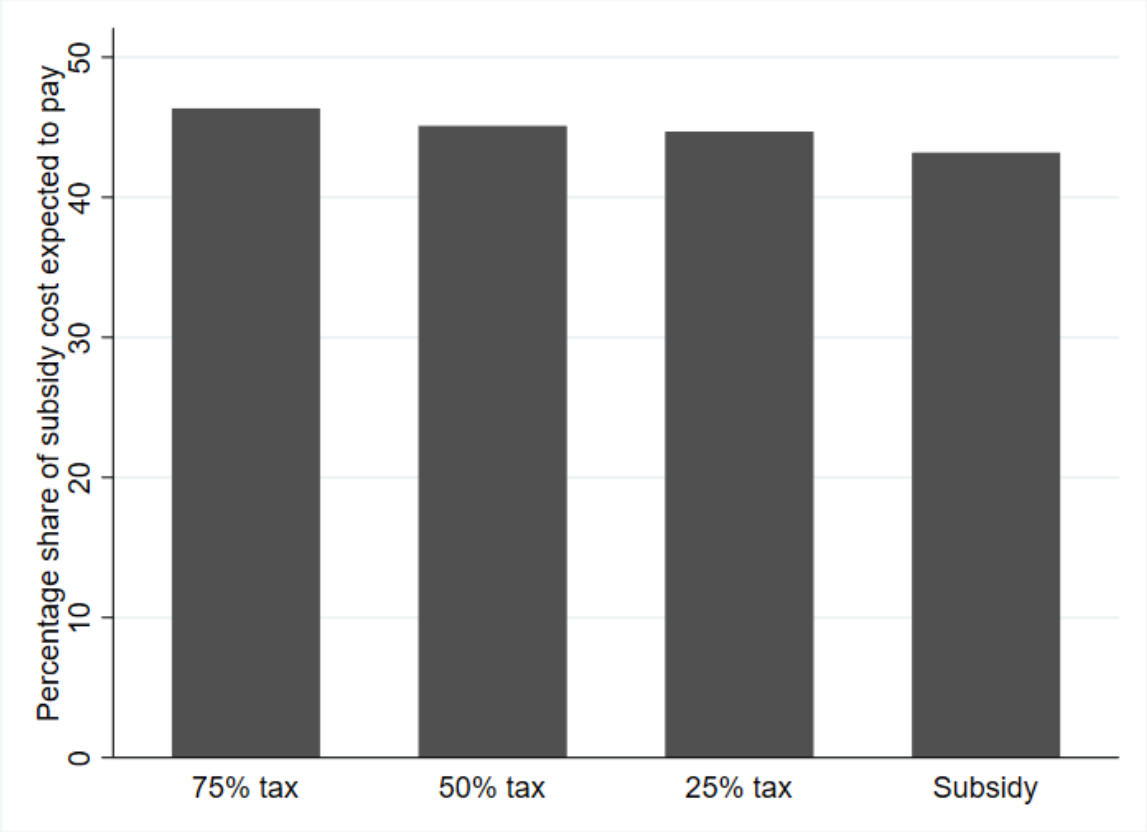


Notes: The 75% tax group also has 25% subsidy. The 50% tax group also has 50% subsidy. The 25% tax group also has 75% subsidy. The difference between the tax group and the 75% tax group is statistically significant.

point of the slider, the difference between the treatments should not be influenced.

3.3.3 Mechanisms: Expecting to pay for the subsidy cost

Figure 6: The share of the subsidy cost expected to pay in the different treatment groups.



Notes: The 75% tax group also has 25% subsidy. The 50% tax group also has 50% subsidy. The 25% tax group also has 75% subsidy. The differences between the groups are not statistically significant.

The average share of the subsidy cost participants expect to pay is 43% in the subsidy treatment group, and expectations are not significantly different from this in the combination treatments, see Figure 6 and in Table A-4, column 1.

In addition, 80% of those in the subsidy group who do *not* expect to pay for the subsidy, voted for the subsidy, see Figure A-3 and Table A-4, column 2. For the combination groups, the probability of voting for the policy declines with the tax share going up, and the difference compared to the subsidy is statistically significant for the 75% tax & 25% subsidy and the 50% tax & 50% subsidy groups, see Table A-4, column 2.

For those expecting to pay a share of the subsidy cost, the support for the policy is lower the higher the tax share in the policy, see Table A-4, column 3 and Figure A-3. This can be because expecting to pay for the subsidy cost is not what determines

the support for the policy. It can also be because the total subsidy cost is lower, the lower the subsidy share of the policy.

3.3.4 Mechanisms: Expectations about the payoff

Only 17% of participants in the tax treatment group expect that the policy will increase their payoff, whereas 60% in the subsidy treatment group do so, see Figure 7 and Table A-5, column 1.[19] The share of participants in the combination treatment groups who expect that the policy will increase their payoff, is increasing in the subsidy share in the policy proposal. This shows again pessimistic beliefs related to taxes.

Among those who expect the policy proposal to increase payoffs, the share voting in favor of the policy is higher for the combination treatment groups than for the tax treatment group, see Figure 7 and Table A-5, column 2. The support for policy does not, however, increase linearly with the subsidy share, as we have seen earlier, see Figure 7. The share supporting the policy among those who expect the policy proposal to increase payoffs, does not significantly differ between the tax treatment group and the 75% tax & 25% subsidy group, but for the two other combination groups the support is statistically different, see Table A-5, column 2.

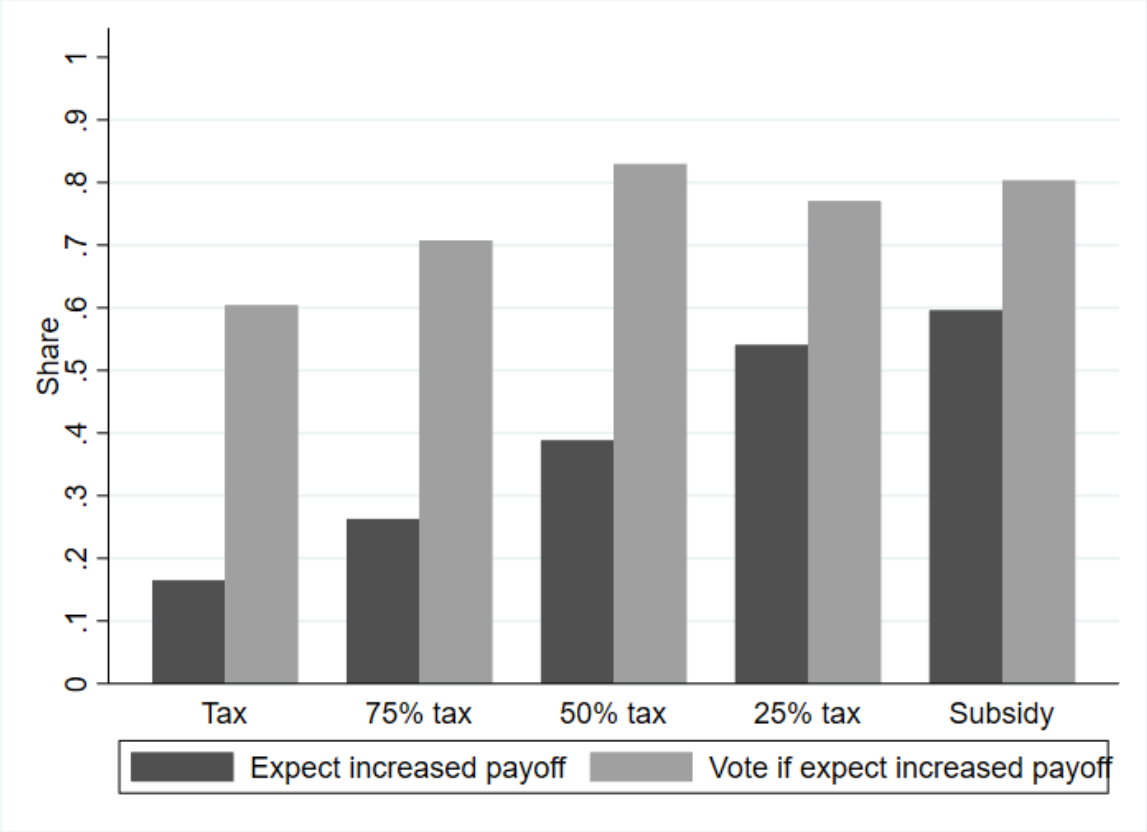
In general, expecting the policy to increase payoff seems to be a clear predictor of voting behavior, but not all who believe the policy to increase payoff voted for the policy. Furthermore, only 39% of the participants expect that the policy will increase their payoff. 77% of those who believe the payoff will increase, vote for the policy (not shown), but this is not even across treatments, as can be seen in Figure 7. This result leads us to investigate the relationship between expectations about tax revenue and subsidy cost and expectations about payoff, see Subsection 3.3.5.

3.3.5 Exploratory analysis: Simulating the expected payoff

We use participants' expectations about policy effectiveness, tax revenue and the subsidy cost to explore if participants expect the payoff to be higher with the policy. As this was not part of our pre-analysis plan, it is an exploratory analysis. This differs from simply asking the participants whether they expect the payoff to increase (which we also did, see Subsection 3.3.4). Here, we instead use the expectations about how many units the others in the groups would buy with or without the policy, what

[19]For both the subsidy and the 25% subsidy & 75% tax group, a higher share of participants expect their payoff to increase if policy is implemented (60% for the subsidy group, see Table A-5) than the share of participants who actually voted for the subsidy (39% for the subsidy group, see Table 7). The reason for this may be that asking questions about the expectations can change participants' thinking about the policies by making certain aspects more salient, or through experimenter demand effects.

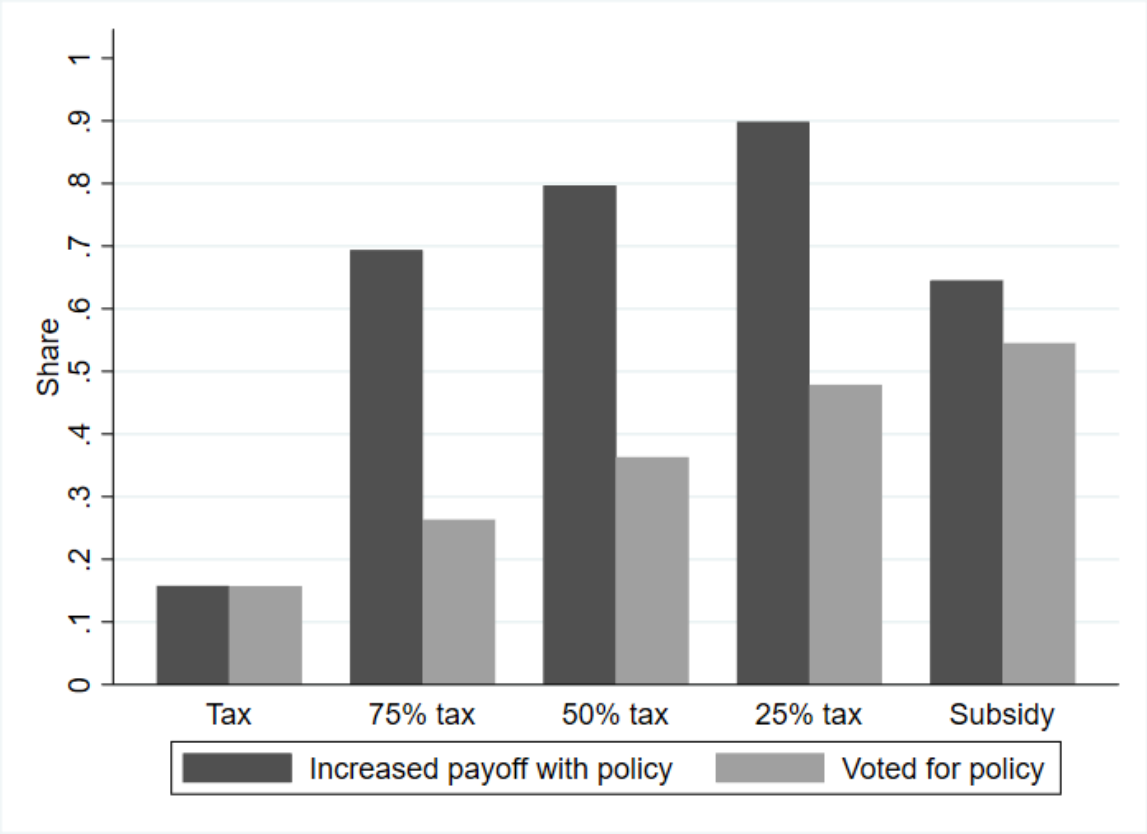
Figure 7: The share expecting the payoff to increase in the different treatment groups and the voting behavior for those that expect increased payoff.



Notes: The 75% tax group also has 25% subsidy. The 50% tax group also has 50% subsidy. The 25% tax group also has 75% subsidy. The voting of those that do not expect the payoff to increase can be seen in Table A-5.

share of the tax revenue one expects to receive, and how much of the subsidy cost one expects to pay, to calculate the expected payoff with and without the proposed policy.[20]

Figure 8: The simulated share expecting increased payoff based on the elements in the payoff (reduced externality because of reduced demand, a share of the tax revenue and a share of the subsidy cost) compared to the voting behavior in the different treatment groups.



Notes: The 75% tax group also has 25% subsidy. The 50% tax group also has 50% subsidy. The 25% tax group also has 75% subsidy.

Figure 8 shows the share expecting increased payoff with policy based on our calculation, and we can compare it with the share voting for the policy, i.e., the same as in Figure 3. We see that participants in the tax group seem to vote according to their payoff expectations, and as noted above these expectations are pessimistic compared to the groups where tax and subsidy are combined.

For the combination groups the number of participants who expect the payoff to increase with policy is much higher than the number of participants that actually

[20]We need to make some assumptions to do this simulation. When policy is not implemented in the second round, we do not know how many units the participant would have chosen to buy with policy. Then we assume that the participant would buy as many units as (s)he expect his/her group members to choose with policy. To calculate the payoff without policy, we use the purchases in the first round. Then we calculate the difference in expected payoff with and without policy.

voted for the policy proposal. This may indicate either that the expectations elicited after the voting were not clear for the participants when they voted, or that something other than the payoff expectations were driving the voting behavior.

3.4 Test for external relevance

We test whether voting for the tax in the experiment is correlated with expressing a willingness to vote for a hypothetical CO_2 tax. The result can be seen in Table 8.

Table 8: Correlation between voting for a tax in the experiment and a hypothetical carbon tax

	(1) Voting for tax
Carbon tax	0.0836
	(0.0470)
Constant	0.130***
	(0.0239)
Observations	303
R^2	0.012

The sample is only the tax treatment group.
Robust standard errors in parentheses
*$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Support for the tax proposal in the experiment correlates with support for the hypothetical CO_2 tax on a 10% significance level. Note, however, that only 48 participants (16%) voted for the tax in the experiment. The support for a hypothetical CO_2 tax is higher (35% of all participants and 34% of the tax group) than the support for a tax in the experiment (16%).

4 Discussion

We find that support for a combination of tax and subsidy approximately equals the simple average of support for the two instruments alone. This main result appears to contradict Milkman et al. (2012) and Fesenfeld (2022), who find that policy packaging increases support (beyond the averaging of support for its constituent parts). Our result also stand in contrast to Eriksson et al. (2008), who find a negative effect of combining policies. It is, however, not possible to make clean comparisons because of important differences in methods and design between the studies. First, our study is incentivized, i.e., participants' choices have real financial consequences for them, whereas none of the three other studies are.

When comparing our results with Milkman et al. (2012), it is important to note that we keep the payoff from the policy equal across treatments (given that the participants follow their dominant strategy). Further, we use fractional combinations where we reduce the tax rate to the same extent as we increase the subsidy rate, whereas in Milkman et al. (2012) the stated gain varies across the policies. The gain from the policy in their study is higher when the two bills are combined than when each bill is considered separately. This difference can potentially explain the difference in voting outcome between our study and Milkman et al. (2012). Another important difference is that Milkman et al. (2012) investigate gains and losses of specific policies, for instance clearing forest (loss) to create jobs (gain), whereas we study policy instruments in a non-contextualized setting. Still, both studies consider bundling of policies that are often viewed as respectively desirable and undesirable. Milkman et al. (2012) find that the reason for the increased support for the policy bundle is that "policy bundling reduces the salience of losses (...) and heightens the salience of gains".

When comparing our results with Fesenfeld (2022), it is important to note that the payoffs from the policies in his study are neither stated (as in Milkman et al. (2012)), nor set to be equal by design (as in our experiment), but left open for respondents to consider themselves. The core idea explored is how greater complexity influences policy perceptions (including public support). The choice experiment in Fesenfeld (2022) has four policy attributes that vary simultaneously and target different behaviours, e.g., taxes for consumers combined with emissions standards for producers. This differs crucially from our experiment where the two instruments target the same behaviour.

In Eriksson et al. (2008) all participants were presented with all policy options (single instruments first and then the packages), and the costs and benefits are not clearly stated nor kept the same across instruments: For the instruments by themselves the specific tax or subsidy rates were not provided, whereas the rates were stated for the policy packages. This latter difference could to some extent explain the result that public support for the packages is closest to the level of support for the least popular instrument: Making policy proposals more specific, e.g., by stating the tax rate, may reduce support and this is only done for the policy packages in Eriksson et al. (2008).

Our findings are generally consistent with Heres et al. (2017), another lab experiment with a market with negative externalities, whose main finding is that subsidies are substantially more popular than taxes, even when payoff is kept constant across policies (if participants choose the dominant strategy). Further, Heres et al. (2017) state that this can in part “be explained by the participants’ expectation that the

subsidy will increase their own payoffs more than a tax, but not because it is expected to be more effective in changing behavior", which is similar to our findings. We introduced the same vagueness regarding the distribution of tax revenues and subsidy funding as Heres et al. (2017), and the (intentional) asymmetry this creates may be an important explanation for the differences in support between taxes and subsidies: The uncertainty for a participant regarding what share of the tax revenue (s)he will receive can be seen as a potential loss (e.g., expecting to receive no share of the revenues, or a smaller share than one's own tax payment), whereas the uncertainty related to paying the subsidy cost can be seen as a potential gain (e.g., expecting not to have to help fund the subsidy, or to fund less than one receives). Thus, the difference in support to the different instruments that both Heres et al. (2017) and we find, can be related to loss aversion.

Status quo bias might explain why many do not support the proposed policies even when they are designed to increase individual and group payoffs (Kahneman et al., 1991; Samuelson & Zeckhauser, 1988), but it does not explain the difference in support between the policies. There seems to be a "broader aversion to market intervention", in line with the findings in Cherry et al. (2012). This could be related to status quo bias.

Another explanation might be that participants view taxes as a more coercive instrument that reduces their own freedom to buy a "dirty" good, rather than an instrument aiming to reduce others' incentives to buy the same "dirty" good (Cherry et al., 2012). Even though the latter effect may be more significant in terms of total welfare effect, the former effect may be more visible or salient to the participant. This, however, needs further investigation. Interestingly, Dechezleprêtre et al. (2022) find that respondents rank a carbon tax as the most costly climate policy, followed by investments in green infrastructure and a ban on combustion-engine vehicles. This indicates that the participants' focus is on the personal costs and benefits, not society's total cost and benefits, which is in line with the findings of Sapienza and Zingales (2013).

Do participants understand the incentive structure fully? One reason participants vote as they do could be that they do not fully understand or take into account the payoff structure. Kallbekken et al. (2011) investigated how much the participants understand and whether more information about how Pigouvian taxes work influenced support. They find that with more information the participants understand more, but it does not change the support for taxes by much. Still, the participants might not take the revenue from the tax and the financing of the subsidy sufficiently into account. Our experimental design does not make it possible to disentangle whether

the participants understand the whole payoff structure. Instead, we build on the findings of Kallbekken et al. (2011), where they test the understanding of the payoff structure, and on Heres et al. (2017) where the role of budgetary information is investigated.

5 Conclusion

In this study, we have conducted an online interactive lab experiment to explore support for taxes, subsidies, and combinations of the two instruments. We find that support increases approximately linearly with the share of subsides in the policy proposal. This finding questions the claim, based on findings in previous studies, that policy packaging can increase public support for unpopular policies. However, given the design of the previous studies, where instrument type and benefits vary together, the findings in those studies might relate to the policy package increasing gains and not the act of packaging as such.

We furthermore find that people hold pessimistic beliefs regarding taxation (especially whether it will increase payoffs), and that this belief scales linearly with the share of taxes in the policy package. Our findings therefore imply that combining a Pigouvian tax with a subsidy does not help reduce tax aversion as such: Support follows the share of the tax in the fractional combinations; the share of participants who expect the payoff to increase with the policy increases only in linear proportion with the subsidy (non-tax) share of the policy, and the belief that taxes are (more) effective does not translate into policy support. The only aspect where combining instruments can be said to influence (an aspect of) tax aversion, is that when combined with a subsidy, respondents expect a larger share of the revenues to be returned to themselves.

The discrepancy between our finding and previous findings on taxes and beliefs about effectiveness raises a question about the causal direction: Do people oppose taxes because they think they are not effective, or do people answer in surveys that taxes are not effective because they do not want taxes? Our findings contrast with what is common in the literature as we find that people both oppose taxes *and* think they are effective. Further investigation on the causal direction between attitudes towards taxes and beliefs about the effectiveness is clearly warranted.

Several extensions of the experiment would be valuable. We chose a design where the packages are fractional combinations of a tax and a subsidy. It would be informative to compare this design to an additive design where the tax remains constant but different policies are added to it in a policy package. Another refinement of our

design would be to ask participants if they want to change their vote after eliciting their expectations, as the act of eliciting the preferences may change their thinking about the policies. In addition, it could be that combining Pigouvian taxes with other kinds of instruments than subsidies in a policy package would yield different results.

Whether the results hold outside of lab experiments is a question for further investigation. Levitt and List (2007, p.168) underline that "many real-world markets operate in ways that make pro-social behavior much less likely" than in a lab experiment. It has been investigated to what degree some types of lab experiments find the same results in real-world settings, such as reaction to competition (Buser & Yuan, 2019). The type of lab experiment we are using has not been investigated for validity outside of the lab, and this is a point for further investigation.

Policy packaging may make sense for a number of reasons, including enhancing effectiveness (van den Bergh et al., 2021), addressing distributional concerns (Bouma et al., 2019), eliciting information about firms' abatement cost (Ambec & Coria, 2021), or directing technological change (Acemoglu et al., 2012). However, unlike what some previous studies have indicated, we do not find that packaging policies increases the level of public support beyond the simple averaging of support for the constituent parts of the package.

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A Additional balance tests

Table A-1: Comparing the difference in the mean for two and two treatment groups. There is no statistically significant difference between the treatment groups. Treatment group 1 is compared with the other groups in Table 6.

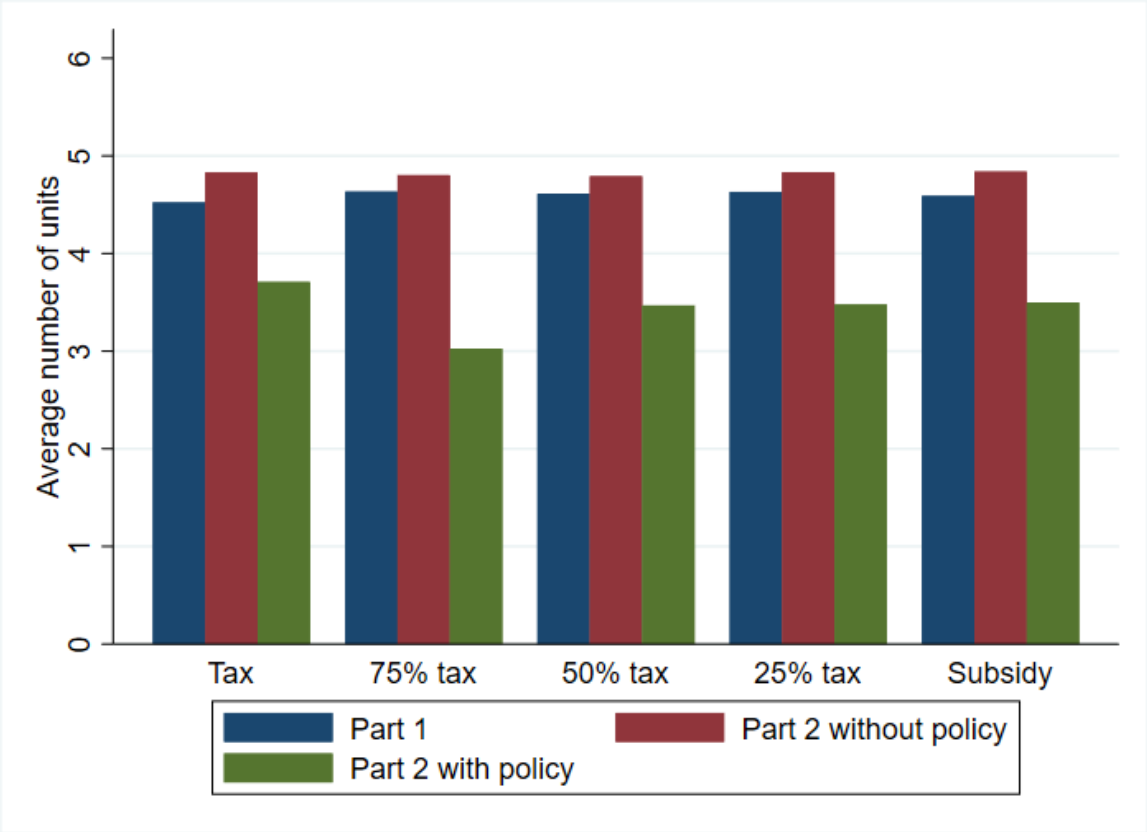
Variable	Treatment group	t-statistics
Age	2&3	1.1274
Age	2&4	1.5787
Age	2&5	-0.4051
Age	3&4	0.4766
Age	3&5	-1.4746
Age	4&5	-1.8961
Gender	2&3	0.2335
Gender	2&4	0.6337
Gender	2&5	1.1260
Gender	3&4	0.3986
Gender	3&5	0.8895
Gender	4&5	0.4918
5 units in part 1	2&3	0.7548
5 units in part 1	2&4	-0.4913
5 units in part 1	2&5	-0.1836
5 units in part 1	3&4	-1.2394
5 units in part 1	3&5	-0.9313
5 units in part 1	4&5	0.3049

The treatment groups are:

1. 100% tax
2. 75% tax and 25% subsidy
3. 50% tax and 50% subsidy
4. 25% tax and 75% subsidy.
5. 100% subsidy

B Additional results

Figure A-1: The average number of units participants buy in the different treatment groups in part 1 and part 2 with and without policy.



Notes: The 75% tax group also has 25% subsidy. The 50% tax group also has 50% subsidy. The 25% tax group also has 75% subsidy.

Table A-2: Expect effect on the demand and voting if expecting or not expecting effect on the demand.

	(1) Expect effect	(2) Vote if expect effect	(3) Vote if do NOT expect effect
Constant (Tax)	0.929***	0.149***	0.217*
	(0.0142)	(0.0205)	(0.0867)
75% tax and 25% subsidy	-0.0919***	0.116***	0.0518
(Hypothesis 1, 5 & 9)	(0.0251)	(0.0339)	(0.107)
50% tax and 50% subsidy	-0.138***	0.253***	-0.00844
(Hypothesis 2, 6 & 10)	(0.0268)	(0.0370)	(0.100)
25% tax and 75% subsidy	-0.174***	0.368***	0.150
(Hypothesis 3, 7 & 11)	(0.0278)	(0.0380)	(0.102)
Subsidy	-0.274***	0.492***	0.160
(Hypothesis 4, 8 & 12)	(0.0298)	(0.0385)	(0.0980)
Observations	1621	1286	335
R^2	0.050	0.130	0.024

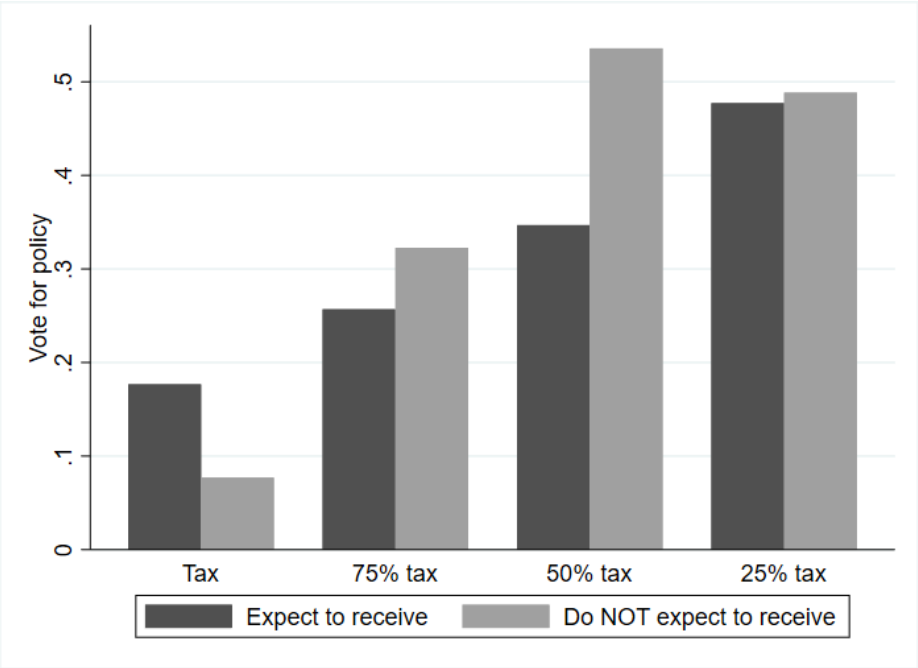
Robust standard errors in parentheses.

*$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Tax treatment group is the baseline.

The coefficient states the difference between the treatment group and the tax group.

Figure A-2: The share voting for the policy in each treatment group for those expecting to receive a share of the tax revenue and those NOT expecting to receive.



Notes: The 75% tax group also has 25% subsidy. The 50% tax group also has 50% subsidy. The 25% tax group also has 75% subsidy.

Table A-3: Share of the tax revenue.

	(1) Expected share	(2) Vote if expecting share	(3) Vote if NOT expecting share
Constant (Tax)	28.42***	0.175***	0.0769*
	(1.278)	(0.0237)	(0.0335)
75% tax and 25% subsidy	8.827***	0.0811*	0.246**
(Hypothesis 13, 16 & 19)	(1.988)	(0.0353)	(0.0913)
50% tax and 50% subsidy	10.80***	0.178***	0.459***
(Hypothesis 14, 17 & 20)	(1.946)	(0.0368)	(0.101)
25% tax and 75% subsidy	12.05***	0.302***	0.411***
(Hypothesis 15, 18 & 21)	(2.065)	(0.0382)	(0.0841)
Observations	1273	1106	167
R^2	0.031	0.057	0.179

Tax treatment group is the baseline.
Robust standard errors in parentheses.
The subsidy treatment group is not part of the analysis because this question is not relevant for the subsidy treatment group.
*$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A-4: Share of the subsidy cost.

	(1) Expected share	(2) Vote if NOT expecting to pay	(3) Vote if expecting to pay
75% tax and 25% subsidy	3.167	-0.527***	-0.242***
(Hypothesis 22, 25 & 28)	(2.205)	(0.123)	(0.0395)
50% tax and 50% subsidy	1.900	-0.354***	-0.140***
(Hypothesis 23, 26 & 29)	(2.206)	(0.128)	(0.0410)
25% tax and 75% subsidy	1.510	-0.221**	-0.0386
(Hypothesis 24, 27 & 30)	(2.273)	(0.103)	(0.0421)
Constant (Subsidy)	43.18***	0.804***	0.504***
	(1.634)	(0.0595)	(0.0300)
Observations	1275	120	1155
R^2	0.002	0.148	0.037

Subsidy treatment group is the baseline.
Robust standard errors in parentheses
The tax treatment group is not part of the analysis because this question is not relevant for the tax treatment group.
*$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A-5: Increase in payoff

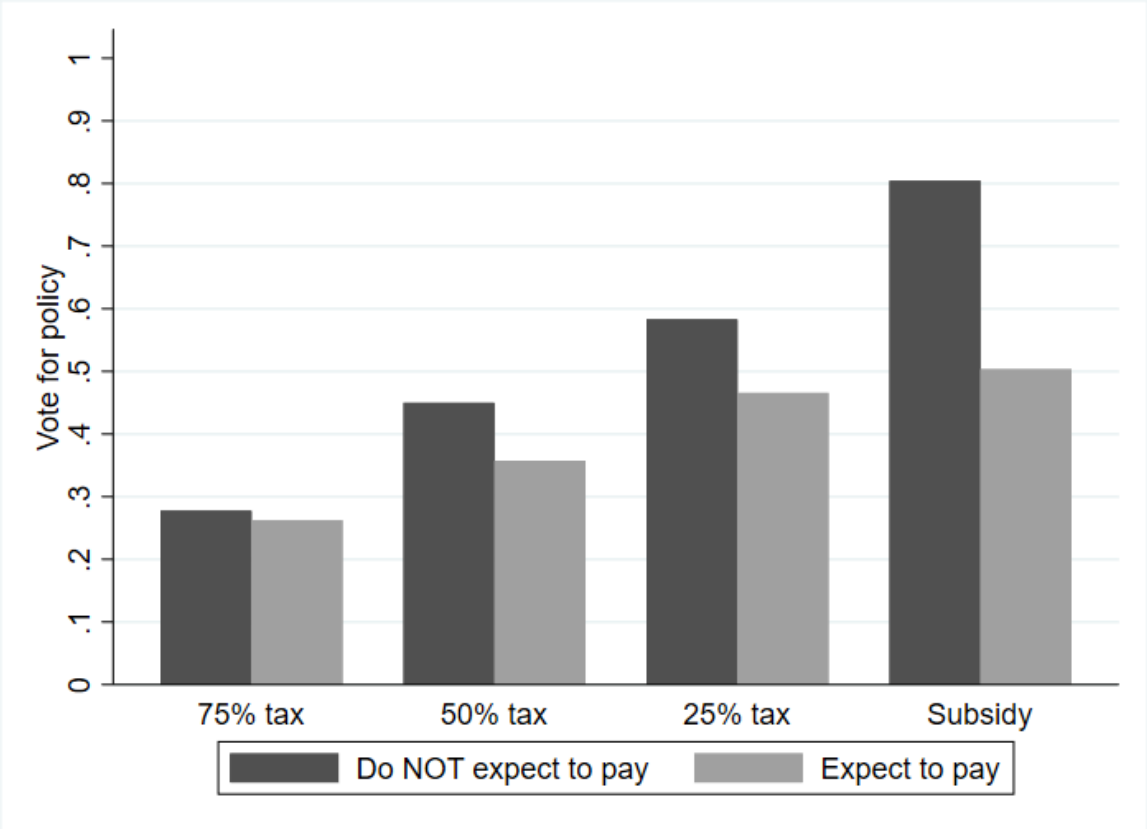
	(1) Expect payoff to increase	(2) Vote if expect to increase payoff	(3) Vote if do NOT expect to increase payoff
Subsidy	0.431***	0.199***	0.101**
(Hypothesis 31, 35 & 39)	(0.0343)	(0.0733)	(0.0361)
25% tax and 75% subsidy	0.376***	0.166**	0.0682*
(Hypothesis 32, 36 & 40)	(0.0347)	(0.0747)	(0.0320)
50% tax and 50% subsidy	0.223***	0.225***	0.0104
(Hypothesis 33, 37 & 41)	(0.0343)	(0.0756)	(0.0246)
75% tax and 25% subsidy	0.0982***	0.104	0.0374
(Hypothesis 34, 38 & 42)	(0.0324)	(0.0842)	(0.0253)
Constant (tax)	0.165***	0.604***	0.0669***
	(0.0207)	(0.0675)	(0.0153)
Observations	1597	625	972
R^2	0.111	0.022	0.013

Tax treatment group is the baseline.

Robust standard errors in parentheses.

*$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure A-3: The share voting for the policy in each treatment group for those expecting to pay a share of the subsidy cost and those NOT expecting to pay.



Notes: The 75% tax group also has 25% subsidy. The 50% tax group also has 50% subsidy. The 25% tax group also has 75% subsidy.

Table A-6: Age interacted with the treatment groups.

	(1)
Subsidy	0.402***
	(0.101)
25% tax & 75% subsidy	0.315**
	(0.100)
50% tax & 50% subsidy	0.366***
	(0.0920)
75% tax & 25% subsidy	0.115
	(0.0886)
Tax × Age	-0.00106
	(0.00123)
Subsidy × Age	-0.00142
	(0.00207)
25% tax & 75% subsidy × Age	-0.000861
	(0.00212)
50% tax & 50% subsidy × Age	-0.00543**
	(0.00178)
75% tax & 25% subsidy × Age	-0.00125
	(0.00164)
Constant	0.197***
	(0.0543)
Observations	1619
R^2	0.093

Robust standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

C Adjustment for several hypothesis

The main hypothesis consists of 7 hypothesis tests. We follow Fink et al. (2014) and use Benjamin - Hochberg adjusted p-values, see Table A-7. Since all the p-values are 0.000, this is does not change anything.

Table A-7: Ordered p-values of the 4 main hypothesis.

k	p-value	Benjamini-Hochberg adjusted p-value required	H_0 rejected?
1	0.000	$\frac{1}{4} * 0.05 = 0.0125$	Yes
2	0.000	$\frac{2}{4} * 0.05 = 0.025$	Yes
3	0.000	$\frac{3}{4} * 0.05 = 0.0375$	Yes
4	0.000	$\frac{4}{4} * 0.05 = 0.05$	Yes

In addition we do the same for the 43 secondary hypothesis that is tested in Table A-2, Table A-3, Table A-4, Table A-5 and Table 8. Table 8 is hypothesis number 43. Each Table has 9-12 0-hypothesis that are tested. When we order all the p-values, none of the coefficients that have a significance level below 5% is rejected because of having many hypotheses. The ordering of the p-values can be seen in Table A-8.

Table A-8: Ordered p-values of the secondary hypothesis.

k	Hypothesis no	p-value	Benjamini-Hochberg adjusted p-value required	H_0 rejected?
1	1	0.000	$\frac{1}{43} * 0.05 = 0.001$	Yes
2	2	0.000	$\frac{2}{43} * 0.05 = 0.002$	Yes
3	3	0.000	$\frac{3}{43} * 0.05 = 0.003$	Yes
4	4	0.000	$\frac{4}{43} * 0.05 = 0.005$	Yes
5	5	0.000	$\frac{5}{43} * 0.05 = 0.006$	Yes
6	6	0.000	$\frac{6}{43} * 0.05 = 0.007$	Yes
7	7	0.000	$\frac{7}{43} * 0.05 = 0.008$	Yes
8	13	0.000	$\frac{8}{43} * 0.05 = 0.009$	Yes
9	14	0.000	$\frac{9}{43} * 0.05 = 0.010$	Yes
10	15	0.000	$\frac{10}{43} * 0.05 = 0.012$	Yes
11	16	0.000	$\frac{11}{43} * 0.05 = 0.013$	Yes
12	17	0.000	$\frac{12}{43} * 0.05 = 0.014$	Yes
13	18	0.000	$\frac{13}{43} * 0.05 = 0.015$	Yes
14	19	0.000	$\frac{14}{43} * 0.05 = 0.016$	Yes
15	22	0.000	$\frac{15}{43} * 0.05 = 0.017$	Yes
16	23	0.000	$\frac{16}{43} * 0.05 = 0.019$	Yes
17	31	0.000	$\frac{17}{43} * 0.05 = 0.020$	Yes
18	32	0.000	$\frac{18}{43} * 0.05 = 0.021$	Yes
19	33	0.000	$\frac{19}{43} * 0.05 = 0.022$	Yes
20	8	0.001	$\frac{20}{43} * 0.05 = 0.023$	Yes
21	24	0.001	$\frac{21}{43} * 0.05 = 0.024$	Yes
22	34	0.002	$\frac{22}{43} * 0.05 = 0.026$	Yes
23	35	0.003	$\frac{23}{43} * 0.05 = 0.027$	Yes
24	36	0.005	$\frac{24}{43} * 0.05 = 0.028$	Yes
25	25	0.006	$\frac{25}{43} * 0.05 = 0.029$	Yes
26	37	0.007	$\frac{26}{43} * 0.05 = 0.030$	Yes
27	20	0.008	$\frac{27}{43} * 0.05 = 0.031$	Yes
28	21	0.022	$\frac{28}{43} * 0.05 = 0.033$	Yes
29	38	0.026	$\frac{29}{43} * 0.05 = 0.034$	Yes
30	26	0.033	$\frac{30}{43} * 0.05 = 0.035$	Yes
31	39	0.034	$\frac{31}{43} * 0.05 = 0.036$	Yes
32	43	0.076	$\frac{32}{43} * 0.05 = 0.037$	No
33	9	0.104	$\frac{33}{43} * 0.05 = 0.038$	No
34	40	0.140	$\frac{34}{43} * 0.05 = 0.040$	No
35	10	0.145	$\frac{35}{43} * 0.05 = 0.041$	No
36	27	0.151	$\frac{36}{43} * 0.05 = 0.042$	No
37	41	0.219	$\frac{37}{43} * 0.05 = 0.043$	No
38	28	0.360	$\frac{38}{43} * 0.05 = 0.044$	No
39	29	0.389	$\frac{39}{43} * 0.05 = 0.045$	No
40	30	0.506	$\frac{40}{43} * 0.05 = 0.047$	No
41	11	0.627	$\frac{41}{43} * 0.05 = 0.048$	No
42	42	0.672	$\frac{42}{43} * 0.05 = 0.049$	No
43	12	0.933	$\frac{43}{43} * 0.05 = 0.05$	No

D Pre-analysis plan

Pre plan: Can combining tax and subsidy generate less public opposition than tax alone?

November 23, 2022

1 Introduction

Pigouvian taxes are politically difficult to introduce at a high enough rate because of opposition from the public. Subsidies on the other hand are often popular. How will a combination of tax and subsidies be considered by ordinary people, compared to each of the policy instruments in isolation? Will a combination of a tax and a subsidy generate less public opposition than tax alone? Is there a difference in the support if the combination is more tax than subsidies or if there is more subsidies than tax? We investigate this in an online interactive experiment.

This plan describes the hypotheses we would like to test and how we will test them. It includes a description of how variables will be coded, and the specification of the estimation equations. All deviations from the plan will be highlighted in the final paper.

We have run pilots to help us design the experiment.

The pre-analysis plan is archived before the experiment starts. We archive the pre-plan at the registry for randomized controlled trials in economics held by The American Economic Association: https://www.socialscienceregistry.org/ before the experiment starts. We will start the experiment on November 24 2022.

2 The sample

The sample consists of people that have United Kingdom as their country of residence.

Our main analysis will include the participants that complete the voting in the experiment. Those that have voting as a non-missing variable defines our sample.

We will conduct the experiment during one day, but if the number of observations are not 1500, we will conduct the experiment one more day and this will continue until we have 1500 observations. We will conduct the experiment during weekdays between 9 am - 5 pm Norwegian time.

Some will not complete because they fail the control questions or do not bother to do the control questions. This means that there will probably be some selection into the experiment based on cognitive abilities and/or dedication.

We do not get information about those that do not complete the experiment from Prolific, so we can not check whether there is balance between those that are in our sample and those that drop out before the voting.

The groups are formed after the control questions. Some will not complete the experiment because the other group members dropped out. We will make a Table that shows how many that are part of the analysis, and the number will probably be reduced for each stage, see Table 1 as example. For each stage someone will experience that a group member drops out because of other disturbances, bad internet connection, not paying attention or other reasons. For each group member dropping out, two other participants will also drop out of the experiment. We choose to analyse all that have voted because we want as many observations as possible and it is random who is in a group that is aborted.

The number that is part of an analysis do not need to be dividable by 3 (the number of participants in a group) because one group member can drop out and the other group members get to answer questions before they are terminated as well.

Table 1: Example of the number of participants being reduced for each stage in the experiment.

Number	**Variable**	**Stage in the experiment**	**N**
1	sam	Voting	1500
2	E	Expectations 1	1400
3	I	Expectations 2	1300
4	CT	Carbon tax	1200

2.1 Balance tests

We will investigate whether the sample is balanced between the five treatment groups on age and gender.

We will also check whether the sample is balanced between the five treatment groups on share of participants choosing 5 units, which is the Nash equilibrium.

3 Coding variables

3.1 Main dependent variable

v_i is a binary variable equal to 1 if the participant voted for a policy and 0 if the participant voted against. Note that this is not whether the policy is implemented, because that depends on whether the policy gets a majority. v_i is generated by combining those voting for a policy in each treatment group.

3.2 Variable that defines the main sample

Those that have v_i as a non-missing variable is our main sample. We generate a variable ("sam") equal to 1 if v_i is non-missing.

3.3 Main independent variables

t_i is a binary variable that indicates whether the participant is in the tax treatment (1) or not (0).

s_i is a binary variable that indicates whether the participant is in the subsidy treatment (1) or not (0).

$c3_i$ is a binary variable that indicates whether the participant is in the treatment with a combination of both tax (25%) and subsidy (75%) (1) or not (0).

$c4_i$ is a binary variable that indicates whether the participant is in the treatment with a combination of both tax (50%) and subsidy (50%) (1) or not (0).

$c5_i$ is a binary variable that indicates whether the participant is in the treatment with a combination of both tax (75%) and subsidy (25%) (1) or not (0).

3.4 Variables used for balance tests

f_i is binary variable that is equal to 1 when the person is female and 0 when male.

a_i is the age and is a discrete variable.

We get the age and gender from Prolific, so we merge the Prolific data with the data from the experiment using Prolific ID as the variable to merge on. If the age and/or gender is missing, the observation is not part of the balancing test on that specific variable.

If the participant chooses 5 units in the first part, the variable $N_i = 1$ and 0 if not.

3.5 Expectations about the effect of the policy

To collect more information on participants' reasons for voting for or against the policy we ask about their expectation for the other group member's choices with or without policy. We generate a variable called $diff_i$ which is the difference between the expectation without or with policy. If $diff_i > 0$, the participant expect the policy to have an effect and the binary variable E_i is equal to 1. If $diff_i \leq 0$, E_i is equal to 0.

3.6 Expectations about the budget

We generate the variable R_i which is a discrete variable that indicate the share of the tax revenue from the other members in the group the participant expects to receive.

We generate the variable S_i which is a discrete variable that indicate the share of the cost of the subsidy for the other members in the group the participant expects to pay.

3.7 Expectations about the payoff

We generate a variable I_i which is equal to 1 if participants believe that the policy will increase their payoff, 0 if they expect no change in the payoff or if they expect the payoff to decrease.

3.8 Carbon tax

The variable CT_i is equal to 1 if the participant support a carbon tax and 0 otherwise.

4 Test of hypothesis

4.1 Main hypothesis: Support for a combination of tax and subsidy compared to only tax and only subsidy

Main hypothesis 1: The percentage support for subsidies and combinations of subsidies and taxes is higher than the percentage support for taxes.

This is the main equation:

$$v_i = \beta_0 + \beta_1 s_i + \beta_2 c3_i + \beta_3 c4_i + \beta_4 c5_i + u_i \tag{1}$$

The tax treatment group is the baseline and all coefficients are compared to the support for taxes. β_1 estimates the difference in support between the tax and the

subsidies and β_2-β_4 estimate the difference in support between the tax and the combinations of subsidies and taxes. The hypothesis states that β_1-$\beta_4 > 0$.

Whether the support for combinations of tax and subsidy is higher the less tax and the more subsidy the combination has is an open question.

Number of hypothesis: 4

Main hypothesis 2: The percentage support for the combination of subsidies and taxes is lower than the percentage support for subsidies.

$$v_i = \beta_0 + \beta_1 t_i + \beta_2 c3_i + \beta_3 c4_i + \beta_4 c5_i + u_i \tag{2}$$

Here the subsidy treatment group is the baseline and all coefficients are compared to the support for the subsidy. β_2-β_4 estimate the difference in support between the subsidy and the combinations of subsidies and taxes. The hypothesis states that β_2-$\beta_4 < 0$.

Number of hypothesis: 3

We have robust standard errors.

4.2 Secondary hypothesis

4.2.1 Mechanisms: Expectations about the effect of the policy

Hypothesis: Expecting the policy to reduce the number of units the other participants buy, increases the support for the policy, across all treatment groups, compared to not expecting the policy to reduce demand in the tax group. Thus, we expect $\gamma_5 - \gamma_9 > 0$ in equation (3). Whether the effects are different across the different treatment groups is an open question which we will investigate.

$$\begin{aligned} v_i = \gamma_0 + \gamma_1 s_i + \gamma_2 c3_i + \gamma_3 c4_i + \gamma_4 c5_i + \\ \gamma_5 E_i \times t_i + \gamma_6 E_i \times s_i + \gamma_7 E_i \times c3_i + \gamma_8 E_i \times c4_i + \gamma_9 E_i \times c5_i + u_i \end{aligned} \tag{3}$$

Number of hypothesis: 5

4.2.2 Mechanisms: Expectations about the revenue from taxes and cost of subsidies

Hypothesis: Expecting to receive tax revenue increases the support for policy, across all treatment groups, compared to not expecting to receive any tax revenue in the tax treatment. Thus, we expect $\gamma_4 - \gamma_7 > 0$ in equation 4. Whether the effects are different across the different treatment groups is an open question which we will investigate.

Here the subsidy treatment group is not part of the analysis because this question has not been asked the subsidy treatment group.

$$v_i = \gamma_0 + \gamma_1 c3_i + \gamma_2 c4_i + \gamma_3 c5_i + \\ \gamma_4 R_i \times t_i + \gamma_5 R_i \times c3_i + \gamma_6 R_i \times c4_i + \gamma_7 R_i \times c5_i + u_i \quad (4)$$

Number of hypothesis: 4

Hypothesis: Expecting to pay for the cost of the subsidy for the others in the group, decreases the support for the policy, across all treatment groups, compared to no expecting to pay in the . Thus, we expect $\gamma_4 - \gamma_7 < 0$ in equation 5. Whether the effects are different across the different treatment groups is an open question which we will investigate.

Here the tax treatment group is not part of the analysis because this question has not been asked the tax treatment group.

$$v_i = \gamma_0 + \gamma_1 c3_i + \gamma_2 c4_i + \gamma_3 c5_i + \\ \gamma_4 S_i \times s_i + \gamma_5 S_i \times c3_i + \gamma_6 S_i \times c4_i + \gamma_7 S_i \times c5_i + u_i \quad (5)$$

Number of hypothesis: 4

4.2.3 Mechanisms: Expectations about the payoff

Hypothesis: Expecting the policy to increase the payoff, increases the support for the policy, across all treatment groups, compared to the the support for tax if the participants expects the payoff to decrease or stay the same. Whether the effects are different across the different treatment groups is an open question which we will

investigate.

$$v_i = \gamma_0 + \gamma_1 s_i + \gamma_2 c3_i + \gamma_3 c4_i + \gamma_4 c5_i + \\ \gamma_5 I_i \times t_i + \gamma_6 I_i \times s_i + \gamma_7 I_i \times c3_i + \gamma_8 I_i \times c4_i + \gamma_9 I_i \times c5_i + u_i \quad (6)$$

Number of hypothesis: 5

4.2.4 Test for external validity

Hypothesis: Voting for tax in the experiment is correlated with voting for a CO2 tax in reality, all though the support for CO2 tax in reality is lower than in the experiment. We expect $\xi_1 > 0$.

$$tax_i = \xi_0 + \xi_1 CT_i + u_I \quad (7)$$

Number of hypothesis: 1

5 Multiple hypothesis testing and power analysis

5.1 Correction for multiple hypothesis testing

Because there are 5 treatment groups, the main hypothesis consists of 7 hypothesis tests. In addition, there are 19 secondary hypothesis. We follow Fink et al. (2014) and will use Benjamin - Hochberg adjusted p-values. This means that we will order all the p-values of the hypothesis. The number of hypothesis is m. The hypothesis will get a number $k = 1, 2, 3, ..., m$ based on the order. The p-value required to reject the null hypothesis is $p_k \leq \frac{k}{m} * 0.05$.

Since there are so many hypothesis on the secondary level, we will treat them as exploratory. We will test the main hypothesis based on $m = 7$.

5.2 Power analysis

We use Stata to calculate the needed sample size. With 80% power, standard deviation of 0.5, significance level of 0.05 and 5 treatment groups, with 1500 participants, we have power to detect a 6 percentage points difference between the different treatment groups and the tax group or the subsidy group.

6 Text analysis

We ask an open question about why they voted as they did. We will make clouds of words that are more frequently used by those voting for a policy in a treatment group compared to those voting for tax, and by those voting against a policy in a treatment group compared to those voting against tax.[1] This is based on Knutsen and Kovacevic (2021).

References

Fink, G., McConnell, M., & Vollmer, S. (2014). Testing for heterogeneous treatment effects in experimental data: False discovery risks and correction procedures. *Journal of Development Effectiveness*, *6*(1), 44–57.

Knutsen, T., & Kovacevic, S. (2021). Pre plan: An experiment on how wage discretion affects distribution preferences.

[1]In order to make a more interesting comparison we will drop words that do no have a lot of content such as: "actually","question", "think", "also" , "participant", "participants", "percent", "therefore", "want", "percentage", "someone", "option", "thought", "made", "person", "decided", "amount","didnt", "scenario", "chose","still", "can","put", "get", "one", "last", "final", "etc", "pair", "isnt", "get", "pairs", "know", "player", "something", "seems", "may", "wanted",, "pay", might", "felt", "thats","hence", "will", "cases", "way", "gave", "need", "participation", "simply", "used", "main"

E Comments on the pre-analysis plan

The main hypothesis remains unchanged from the pre-analysis plan. Here we state the secondary hypotheses as phrased in the pre-analysis plan and explain how they were altered. The rephrasing of the secondary hypotheses is done to have a more relevant comparison group. The topics we test and the coding of the variables adheres to the pre-analysisplan, it is only what we compare with that is changed. The rephrasing of the secondary hypotheses follows the same pattern for all topics. The results following the comparison in the pre-analysisplan can be seen in Table A-9 in Appendix F.

E.1 Secondary hypothesis

E.1.1 Mechanisms: Expectations about the effect of the policy

Hypothesis in the pre-analysisplan: "Expecting the policy to reduce the number of units the other participants buy, increases the support for the policy, across all treatment groups, compared to not expecting the policy to reduce demand in the tax group."

Comment on the hypothesis: Comparing the voting of both those that expect an effect and those that do not expect an effect with the tax group that do not expect an effect, is not focusing on the most interesting comparison. In addition it is interesting to investigate the expectation about an effect across the treatment groups, not just the voting behavior. Therefore, we

1. Test if there is a statistically significant difference between the treatment groups on the expectation of the effect of the policy
2. Test if there is a statistically significant difference in the support for the policy between the treatment groups for the participants that expect an effect.
3. Test if there is a statistically significant difference in the support for the policy between the treatment groups for the participants that *do not* expect an effect.

E.1.2 Mechanisms: Expectations about the revenue from taxes and cost of subsidies

Hypothesis in the pre-analysisplan: "Expecting to receive tax revenue increases the support for policy, across all treatment groups, compared to not expecting to receive any tax revenue in the tax treatment."

Comment on the hypothesis: Comparing the voting of both those that expect to receive revenue for the tax and those that do not expect to receive revenue with

the tax group that do not expect to receive any revenue, is not focusing on the most interesting comparison. In addition it is interesting to investigate the share of the tax revenue the participants expect to receive across the treatment groups, not just the voting behavior. Therefore, we

1. Test if there is a statistically significant difference between the treatment groups on the share of the tax revenue the participants expects to receive.

2. Test if there is a statistically significant difference in the support for the policy between the treatment groups for the participants that expect to receive a share of the tax revenue.

3. Test if there is a statistically significant difference in the support for the policy between the treatment groups for the participants that *do not* expect to receive a share of the tax revenue.

Hypothesis in the pre-analysisplan: "Expecting to pay for the cost of the subsidy for the others in the group, decreases the support for the policy, across all treatment groups, compared to no expecting to pay in the [Here a word is lacking, but it should be "subsidy group"]"

Comment on the hypothesis: Comparing the voting of those that expect to pay for the subsidy and those that do not expect to pay with the subsidy group that do not expect to pay is not focusing on the most interesting comparison. In addition it is interesting to investigate the share of the subsidy cost the participants expect to pay across the treatment groups, not just the voting behavior. Therefore, we

1. Test if there is a statistically significant difference between the treatment groups the share the participants expects to pay.

2. Test if there is a statistically significant difference in the support for the policy between the treatment groups for the participant that *do not* expect to pay.

3. Test if there is a statistically significant difference in the support for the policy between the treatment groups for the participant that expect to pay.

E.1.3 Mechanisms: Expectations about the payoff

Hypothesis: "Expecting the policy to increase the payoff, increases the support for the policy, across all treatment groups, compared to the the support for tax if the participants expects the payoff to decrease or stay the same."

Comment on the hypothesis: Comparing the voting of those that expect the payoff to increase and those that do not expect the payoff to increase in the tax

group is not focusing on the most interesting comparison. In addition it is interesting to investigate the expectation about the payoff across the treatment groups, not just the voting behavior. Therefore, we

1. Test if there is a statistically significant difference between the treatment groups on the expectation for the payoff to increase.

2. Test if there is a statistically significant difference in the support for the policy between the treatment groups where the participant expect the payoff to increase.

3. Test if there is a statistically significant difference in the support for the policy between the treatment groups where the participant *do not* expect the payoff to increase.

E.2 Text analysis

We compared the words more frequently used in the open ended question about why the participants voted as they did. We compare those that voted *against* policy in the 100% tax group, the 100% subsidy group and the 50% tax & 50% subsidy group in Figure A-4. And in Figure A-5 we compare those that voted *for* policy in the 100% tax group, the 100% subsidy group and the 50% tax & 50% subsidy group. We do not think the word clouds provide particularly interesting insights and have therefore placed them in Appendix F.

F Results from following the pre-analysisplan

F.1 The regression equations (3)-(6)

Table A-9: The regression equations in the preplan estimated.

	(3) Effect	(4) Tax revenue	(5) Subsidy cost	(6) Payoff
Subsidy	0.160			0.101**
	(0.0976)			(0.0362)
25% tax & 75% subsidy	0.150	0.411***	-0.221*	0.0682*
	(0.102)	(0.0833)	(0.101)	(0.0321)
50% tax & 50% subsidy	-0.00844	0.459***	-0.354**	0.0104
	(0.0996)	(0.100)	(0.126)	(0.0246)
75% tax & 25% subsidy	0.0518	0.246**	-0.527***	0.0374
	(0.106)	(0.0905)	(0.121)	(0.0253)
Tax interaction term	-0.0689	0.0982*		0.537***
	(0.0887)	(0.0408)		(0.0691)
Subsidy interaction term	0.263***		-0.301***	0.635***
	(0.0560)		(0.0659)	(0.0436)
25% tax & 75% subsidy interaction term	0.149*	-0.0117	-0.118	0.635***
	(0.0632)	(0.0821)	(0.0876)	(0.0426)
50% tax & 50% subsidy interaction term	0.193**	-0.183	-0.0864	0.752***
	(0.0586)	(0.0987)	(0.115)	(0.0391)
75% tax & 25% subsidy interaction term	-0.00431	-0.0664	-0.0159	0.603***
	(0.0674)	(0.0882)	(0.109)	(0.0543)
Constant	0.217*	0.0426	0.732***	0.0669***
	(0.0863)	(0.0277)	(0.0448)	(0.0153)
Observations	1621	1273	1275	1597
R^2	0.112	0.073	0.061	0.469

Robust standard errors in parentheses.

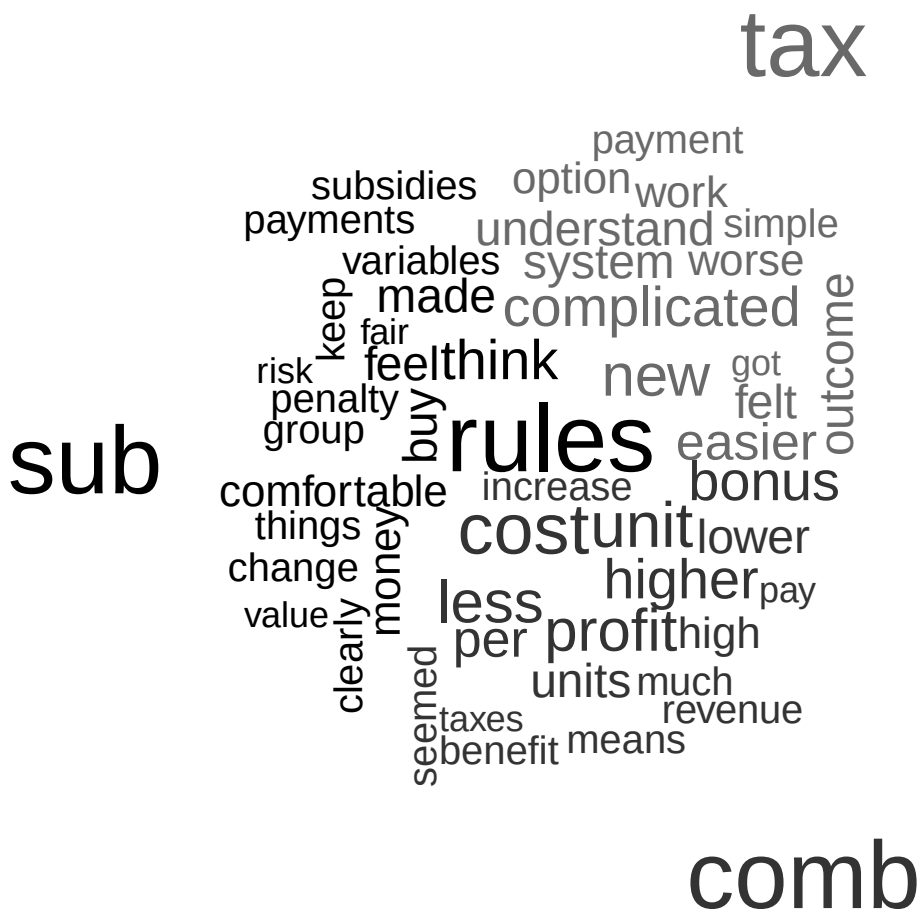
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The column numbers refer to the regression equations 3-6 in the pre-analysis plan.

The interaction terms are the treatment groups interacted with the variable in the header. This means that column 1 interaction terms are the treatment groups interacted with expecting effect. Column 2 interaction terms are the treatment groups interacted with whether the participants expect a share of the tax revenue, and so on.

F.2 Word cloud

Figure A-4: Comparing explanations for voting AGAINST the policy for the 100% tax group ("tax"), the 100% subsidy group ("sub") and the 50% tax & 50% subsidy group ("comb").



The words in the same grey scale as "tax" are the words that people in the tax group mentioned more, relative to people in the two other groups (similar for "sub" and "comb"). The size of the word tells us the relative number of people mentioning it.

Figure A-5: Comparing explanations for voting FOR the policy for the 100% tax group ("tax"), the 100% subsidy group ("sub") and the 50% tax & 50% subsidy group ("comb").

The words in the same grey scale as "tax" are the words that people in the tax group mentioned more, relative to people in the two other groups (similar for "sub" and "comb"). The size of the word tells us the relative number of people mentioning it.

G Details about the experiment design

G.1 All instructions for the 100% tax treatment group

G.1.1 Introduction

Welcome

Thank you for taking part in this market experiment developed for research purposes.

You are guaranteed to earn £1.5 if you and your group members complete the experiment. The estimated time to complete is 15 minutes.

In addition, you can earn a bonus payment depending on your decisions in the experiment (but not your answers in the survey).

You will be in a group with two real people that are doing the experiment at the same time. It is therefore important that you complete without interruptions.

If one of the participants in your group drops out, you cannot continue, and you will receive compensation for the time you spent on the study in line with Prolific payment principles. In this case you will not receive bonus payment because the bonus payment is calculated at the end of the experiment.

The money in the experiment is in tokens. 100 tokens equals £1.

All interactions are anonymous.

Before you can enter the experiment, you will receive instructions and we will ask you some control questions to test that you understand the instructions.

You will receive compensation for the time you spent only if you answer the control questions correctly and start the actual study.

We recommend you to have a calculator ready, for instance on your mobile phone or your laptop.

At the end of the study, you will get a code that you can enter into Prolific to show that you have finished the study.

Please write your participant ID below so that we can pay your earnings later:

remaining characters 24

Continue

Do you understand the information below and do you consent to taking part in this study? If so, please press the button "I consent" and then the button "Continue".

I consent

I do not consent

Continue

Are you interested in taking part in the research project «attitudes towards regulation of markets»?

Purpose of the project: You are invited to participate in a research project where the main purpose is to study behaviour in a market. Governments can make use of different policies to influence how people behave in markets. People's attitudes to the choice of policies, and to whether it is necessary or not to regulate a market, are important for which policy decisions that are taken. In this study we will first ask you to make decisions in a fictitious market, and later ask you about your personal views on different types of persons.

Which institution is responsible for the research project? CICERO Center for international climate research is responsible for the project (data controller). The project is funded by the Research Council of Norway.

Why are you being asked to participate? You signed up as a potential participant for research studies at Prolific, and expressed an interest in taking part in this specific study when you clicked the link shared by Prolific.

What does participation involve for you? The study is an online experiment where you make decisions in a fictitious market and answer survey questions. It will typically require 15 minutes to complete. The information is stored digitally. We will ask for your Prolific ID in order to be able to pay for your participation.

Participation is voluntary. If you choose to participate, you can withdraw your consent at any time without giving a reason. All information about you will then be made anonymous. There will be no negative consequences for you if you choose not to participate or later decide to withdraw. We will, however, not be able to pay you if you do not finish the study.

Your personal privacy – how we will store and use your personal data. We will only use your personal data for the purpose(s) specified here and we will process your personal data in accordance with data protection legislation (the GDPR). Your personal data in this study is your Prolific ID. The Prolific ID will make it possible for us to pay you and to get the demographic information you have given to Prolific. We do not have access to information that can identify you such as name, email address or IP-address.

We will only use your Prolific ID for the purposes specified here. We will process your Prolific ID confidentially and in accordance with data protection legislation (the General Data Protection Regulation and Personal Data Act). CICERO will only have access to your Prolific ID while the study is ongoing. Once the study is completed, and we have informed Prolific about how much you earned in the study (and downloaded the demographic data from Prolific), we will delete your Prolific ID from our records, and keep only the anonymized answers.

Three people in the project team will have access to the answers you give in this study. The answers will be stored on an encrypted server with two-factor authentication. No participants will be recognizable in the research publications that we will write based on the experiment.

G.1.2 Instructions part 1

Instructions, page 1/5

You and two other participants are buyers in a market. You can buy up to 6 units of a good.

Each unit of the good has a different value, but the price is the same. The first unit has the highest value and then each additional unit is worth less. The value of the units you buy is used to calculate your bonus payment each round.

You will make a decision once on how many units to buy, before receiving new instructions and make a new decision. The decision you make in part 1 do not influence the rules and alternatives in part 2.

Continue

Instructions, page 2/5

This is how your bonus payment is calculated:

The value of the unit(s) you buy

minus

the price of the unit(s) you buy

Continue

Back to instructions page 1

Instructions, page 3/5

The price you pay for each unit of the good is 40 tokens.

The value of each unit is:

130	110	90	70	50	30

In a pilot we had, a majority chose 5 units.

Continue

Back to instructions page 1

Back to instructions page 2

Instructions, page 4/5

There is one more feature of the market that affects your bonus payment. Buying the good creates an additional cost. For each unit a buyer in the group purchases, a cost of 20 tokens is imposed on each of the two other members of the group.

Continue

Back to instructions page 1

Back to instructions page 2

Back to instructions page 3

Instructions, page 5/5

Example:

If you choose 5 units, and the other two members in your group choose 3 units, your bonus payment in that round would be:

The value of the 5 units: 130 + 110 + 90 + 70 + 50 = 450

minus

The cost of your 5 units: 40*5 = 200

minus

the additional cost imposed on you by the purchases of the two others in your group: 3*20 + 3*20 = 120

= 450 - 200 - 120 = 130

Summary:

The price you pay for each unit of the good is 40 tokens.

The value of each unit is:

130	110	90	70	50	30

For each unit a buyer in the group purchases, a cost of 20 tokens is imposed on each of the two other participants in the group.

Continue

Back to instructions page 1 | Back to instructions page 2

G.1.3 Control questions

(1) How much do you earn in bonus payment if you buy 3 units and the two others in your group buy 5 units each?

(2) How much do you earn in bonus payment if you buy 5 units and the two others in your group buy 5 units each?

The price is 40 tokens per unit.

The value of each unit is:

130	110	90	70	50	30

The additional cost the others impose on you is 20 tokens per good they buy.

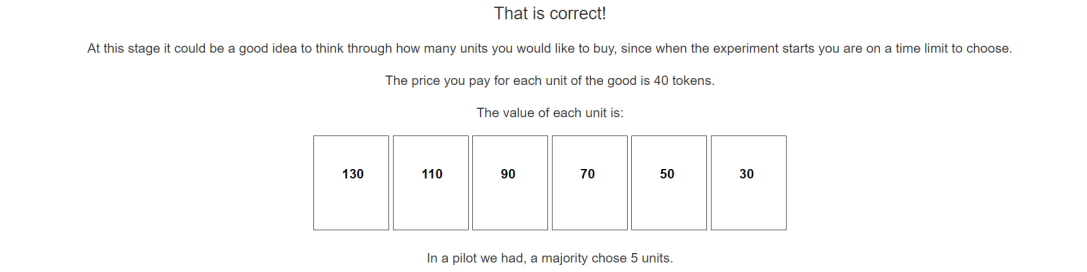
Submit answer

Attempts left to answer the control questions: 3

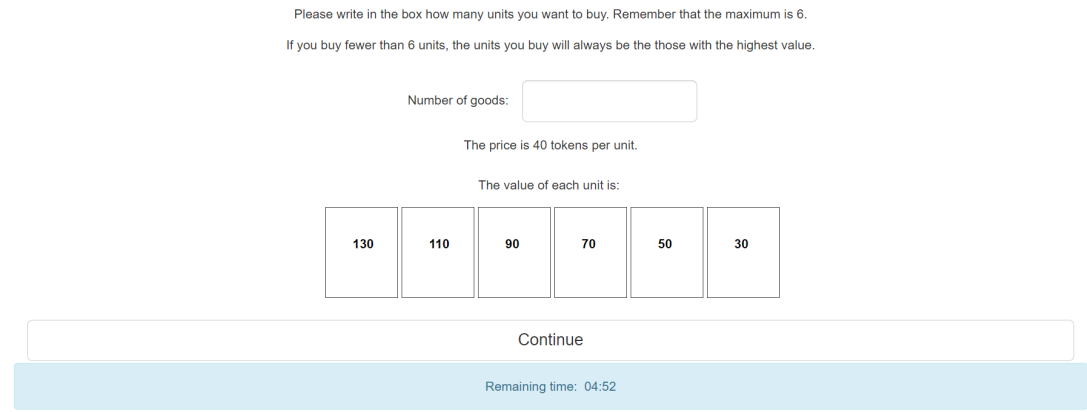
Back to instructions part 1 | Back to instructions part 2

Back to instructions part 3 | Back to instructions part 4 | Back to instructions part 5

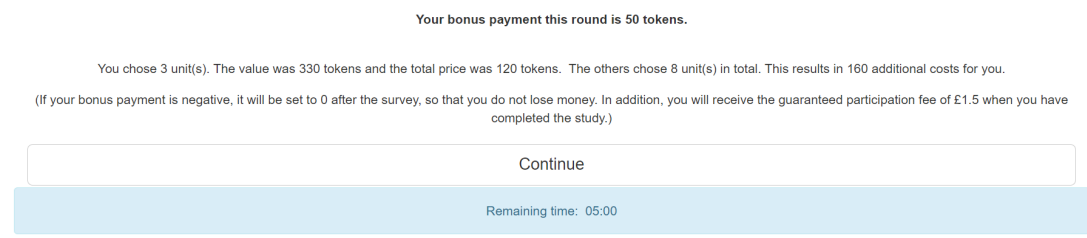
G.1.4 Results from the control question



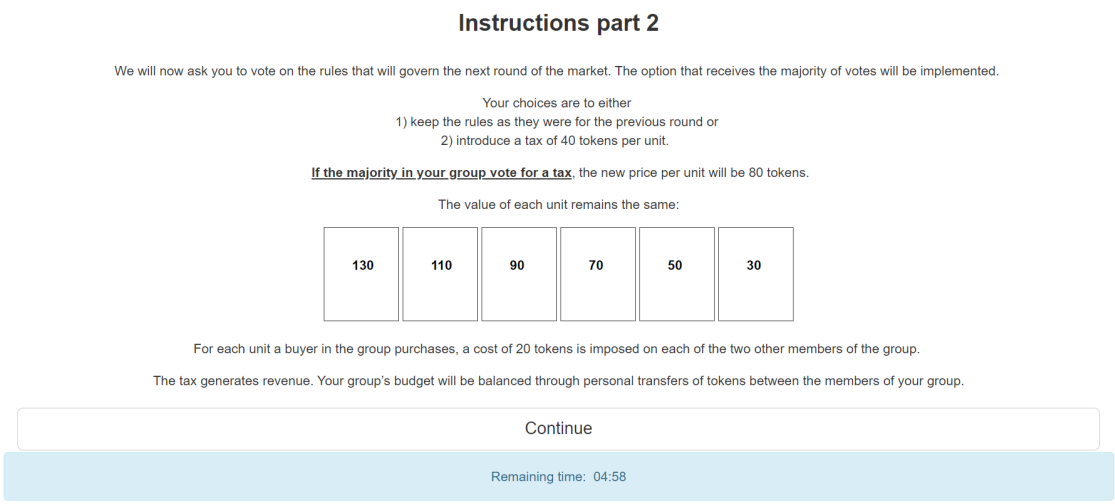
G.1.5 Purchase of goods part 1, equal for all treatment groups



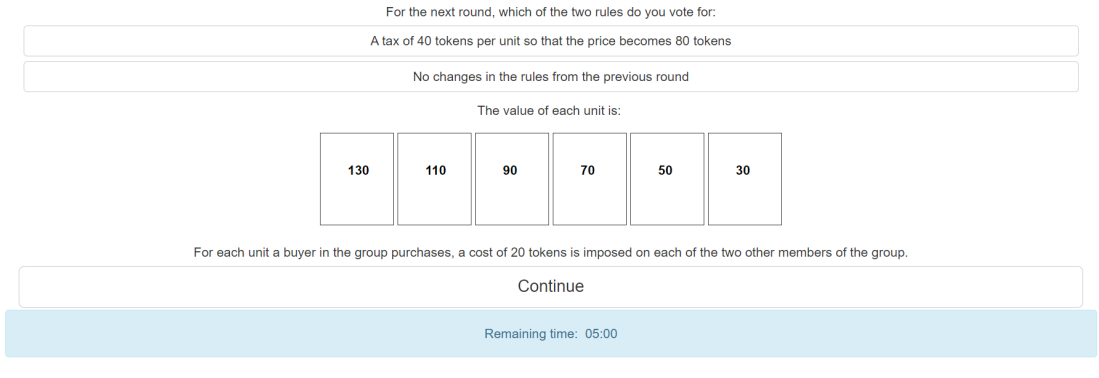
G.1.6 Result bonus payment part 1, equal for all treatment groups



G.1.7 Instructions part 2, 100% tax treatment group



G.1.8 Voting, 100% tax treatment group



G.1.9 Expectations, 100% tax treatment group

1) If the tax is implemented, how many goods do you expect each of the other persons in your group will buy? (Your answer does not influence your payment)

2) If the tax is NOT implemented, how many goods do you expect each of the other persons in your group will buy? (Your answer does not influence your payment)

If tax is implemented, the price per unit is 80 tokens.

If tax is NOT implemented, the price per unit is 40 tokens.

The value of each unit is:

130	110	90	70	50	30

For each unit a buyer in the group purchases, a cost of 20 tokens is imposed on each of the two other members of the group.

Continue

Remaining time: 04:57

1) If the policy is implemented, how much of the revenue from the tax the others pay do you expect to receive?

0% 100%

%

2) If the tax is implemented, what do you think will happen to your payoff?

Increase

Decrease

No change

If tax is implemented, the price per unit is 80 tokens.

If tax is NOT implemented, the price per unit is 40 tokens.

The value of each unit is:

130	110	90	70	50	30

For each unit a buyer in the group purchases, a cost of 20 tokens is imposed on each of the two other members of the group.

Continue

Remaining time: 04:58

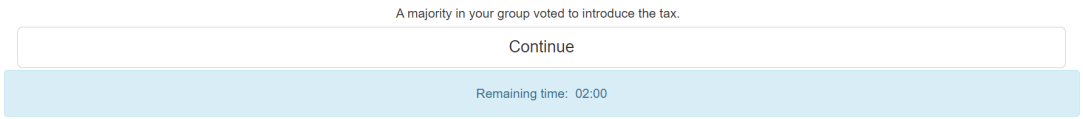
G.1.10 Open text question, 100% tax treatment group

Why did you vote to introduce the tax? (Your answer does not influence your payment)

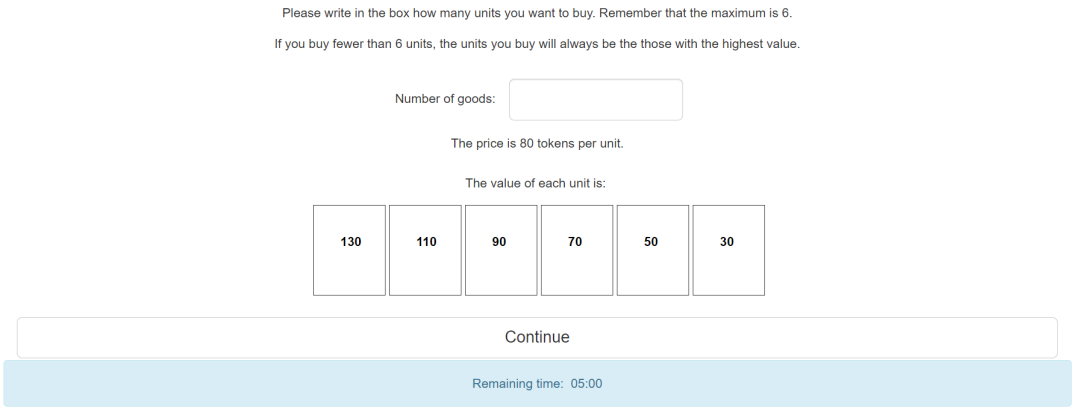
Continue

Remaining time: 04:56

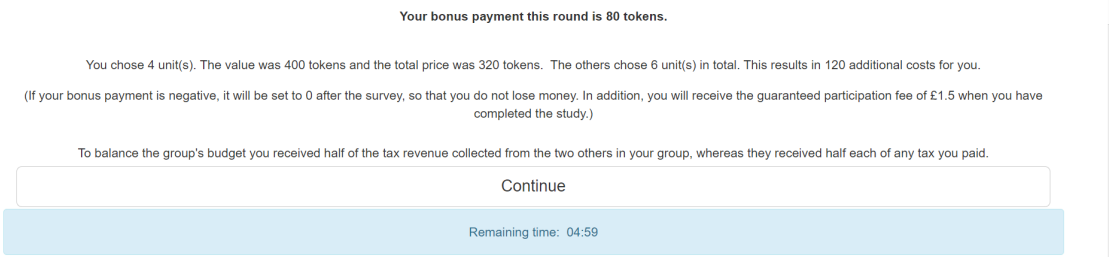
G.1.11 Result from voting if majority for the policy, 100% tax treatment group



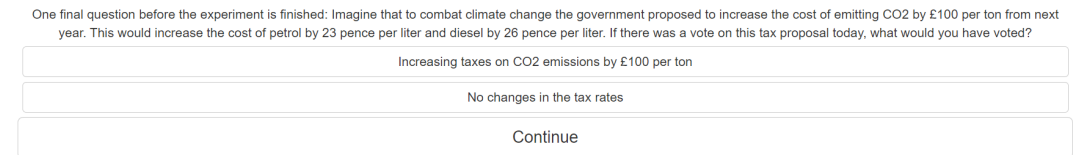
G.1.12 Purchase of goods part 2, 100% tax treatment group



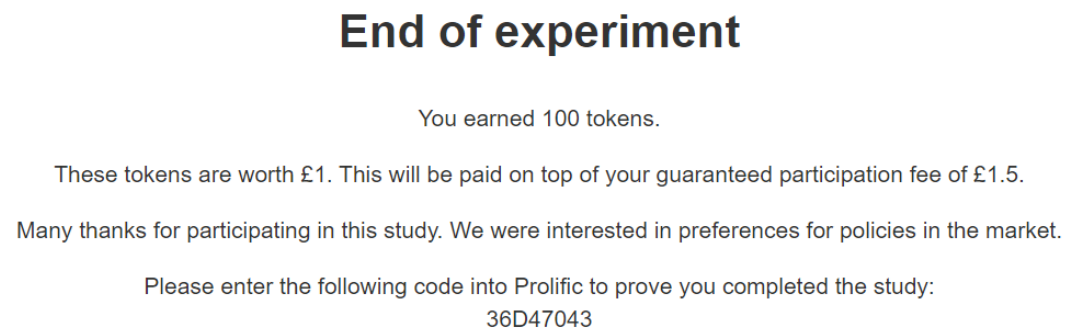
G.1.13 Result bonus payment part 2, 100% tax treatment group



G.1.14 Question about hypothetical CO2 tax, equal for all treatment groups

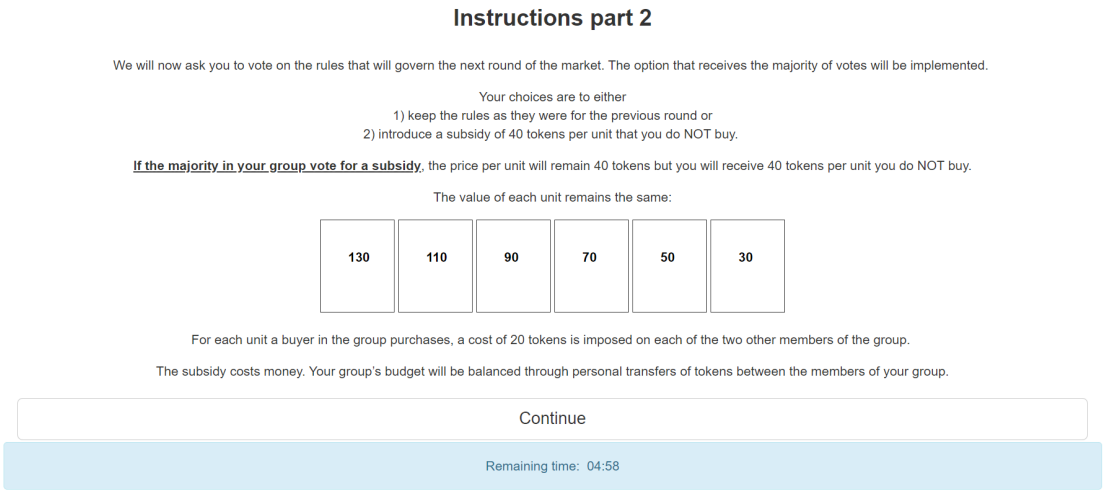


G.1.15 End of experiment, equal for all treatment groups

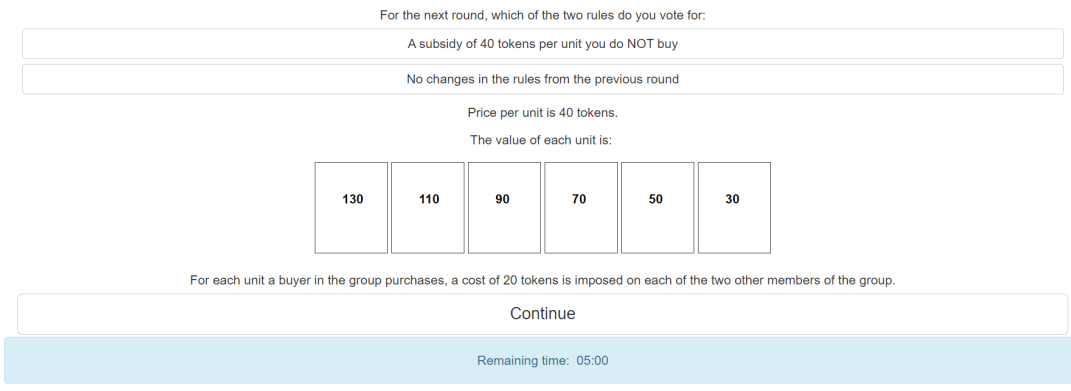


G.2 Instructions for the 100% subsidy treatment group, when it differs from the 100% tax treatment group

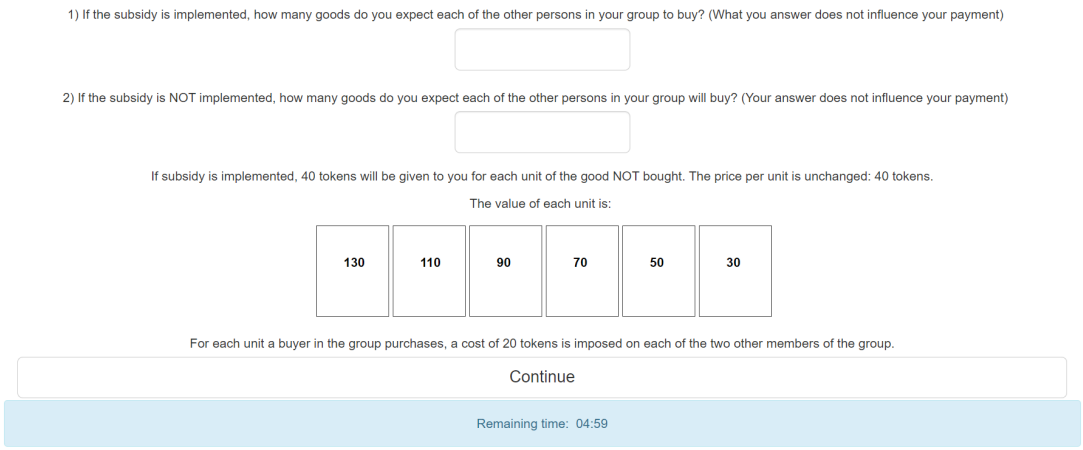
G.2.1 Instructions part 2, 100% subsidy treatment group

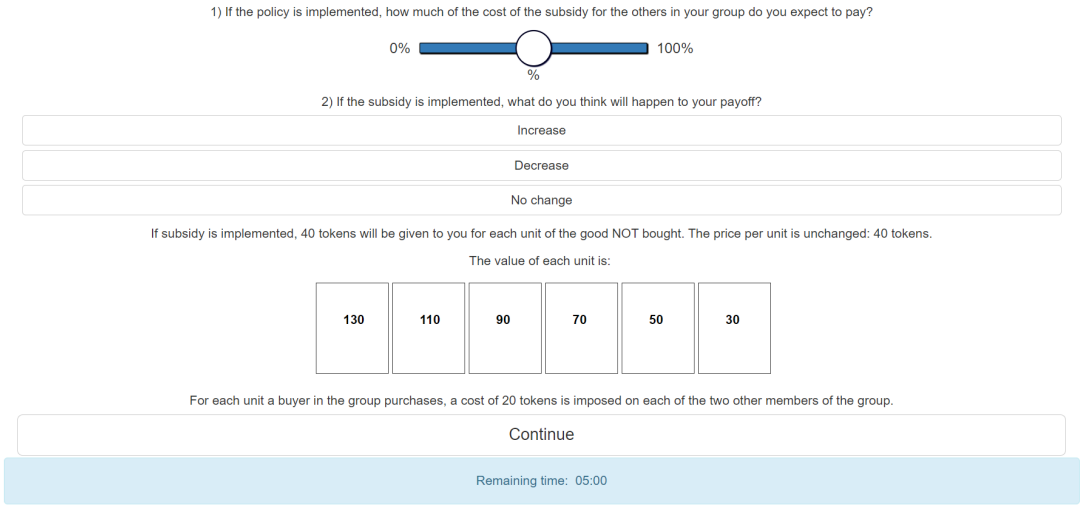


G.2.2 Voting, 100% subsidy treatment group

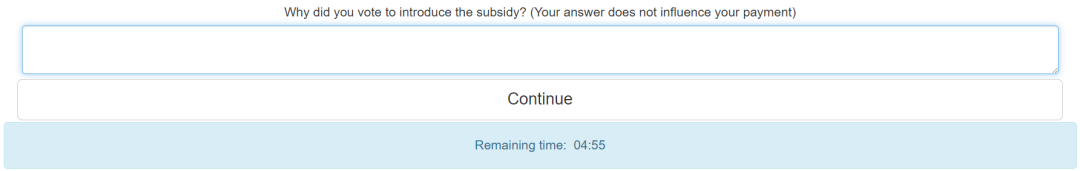


G.2.3 Expectations, 100% subsidy treatment group

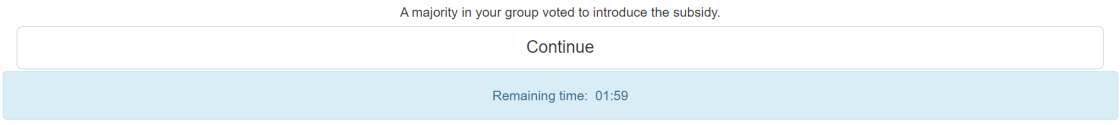




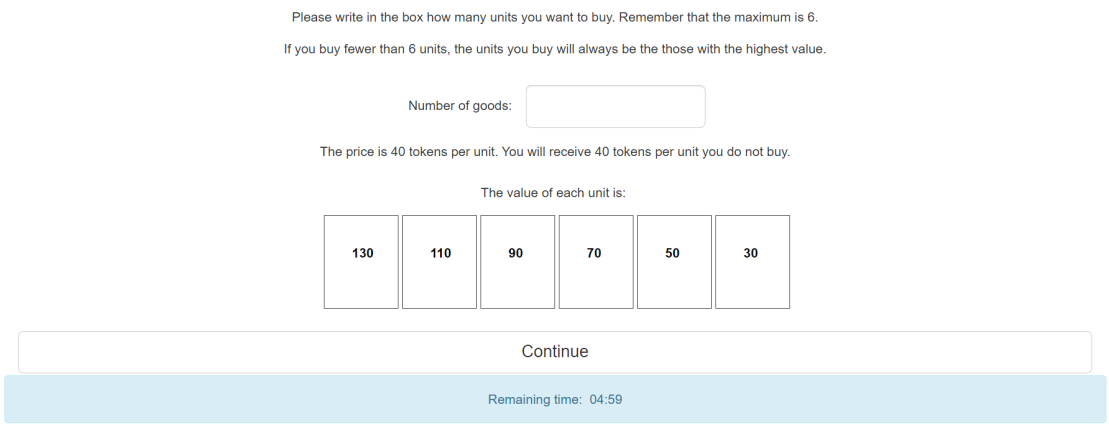
G.2.4 Open text question, 100% subsidy treatment group



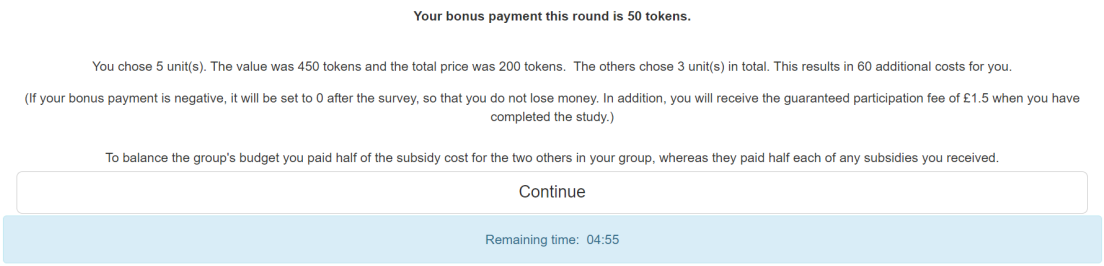
G.2.5 Result from voting if majority for the policy, 100% subsidy treatment group



G.2.6 Purchase of goods part 2, 100% subsidy treatment group

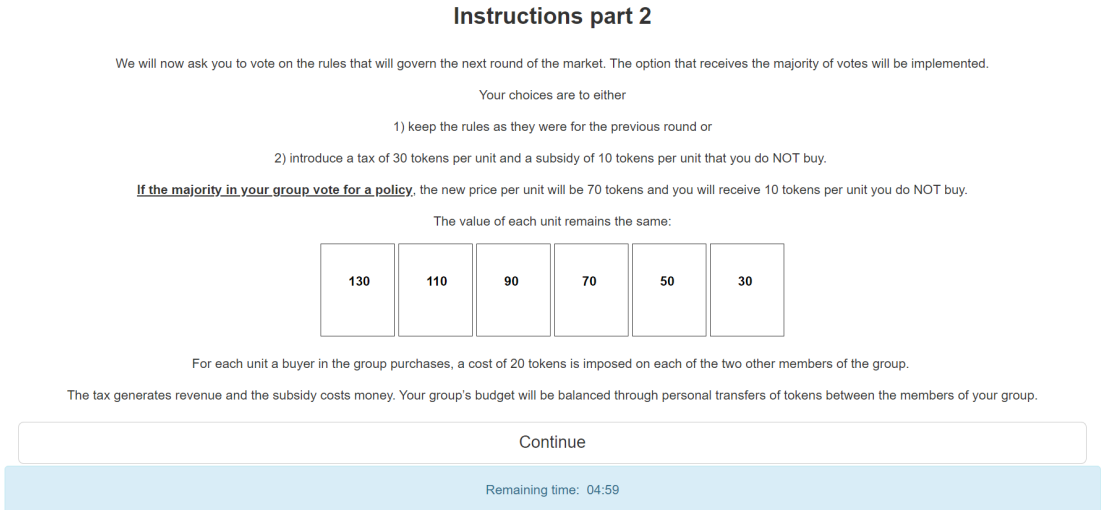


G.2.7 Result bonus payment part 2, 100% subsidy treatment group



G.3 Instructions for the 75% tax & 25% subsidy treatment group, when it differs from the 100% tax treatment group, as an example of the combination treatment groups

G.3.1 Instructions part 2, 75% tax & 25% subsidy treatment group



G.3.2 Voting, 75% tax & 25% subsidy treatment group

For the next round, which of the two rules do you vote for:

A tax of 30 tokens per unit so that the price becomes 70 tokens, and a subsidy of 10 tokens per unit you do NOT buy

No changes in the rules from the previous round

The value of each unit is:

130	110	90	70	50	30

For each unit a buyer in the group purchases, a cost of 20 tokens is imposed on each of the two other members of the group.

Continue

Remaining time: 04:59

G.3.3 Expectations, 75% tax & 25% subsidy treatment group

1) If the tax and subsidy is implemented, how many goods do you expect each of the other persons in your group to buy? (Your answer does not influence your payment)

2) If the tax and subsidy is NOT implemented, how many goods do you expect each of the other persons in your group will buy? (Your answer does not influence your payment)

If the tax and the subsidy is implemented, the price per unit is 70 tokens and 10 tokens will be given to you for each unit of the good not bought.

If the tax and the subsidy is NOT implemented, the price per unit is 40 tokens.

The value of each unit is:

130	110	90	70	50	30

For each unit a buyer in the group purchases, a cost of 20 tokens is imposed on each of the two other members of the group.

Continue

Remaining time: 04:59

1) If the policy is implemented, how much of the revenue from the tax the others pay do you expect to receive?

0% 100%

%

2) If the policy is implemented, how much of the cost of the subsidy for the others in your group do you expect to pay?

0% 100%

%

3) If the tax and subsidy is implemented, what do you think will happen to your payoff?

Increase

Decrease

No change

If the tax and the subsidy is implemented, the price per unit is 70 tokens and 10 tokens will be given to you for each unit of the good not bought.

If the tax and the subsidy is NOT implemented, the price per unit is 40 tokens.

The value of each unit is:

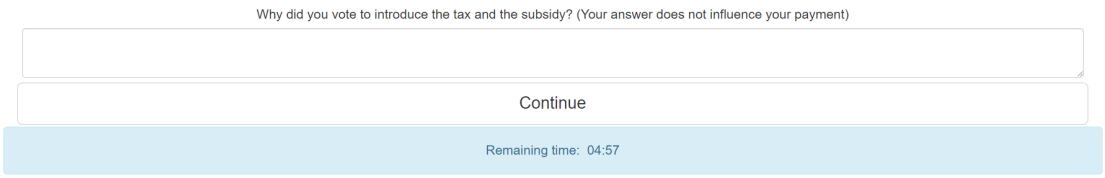
130	110	90	70	50	30

For each unit a buyer in the group purchases, a cost of 20 tokens is imposed on each of the two other members of the group.

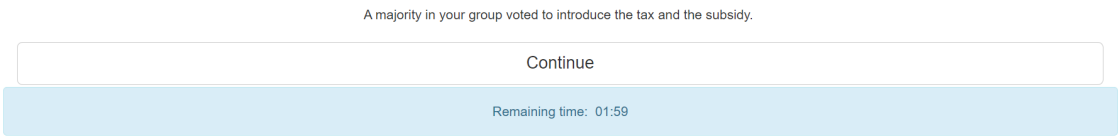
Continue

Remaining time: 04:59

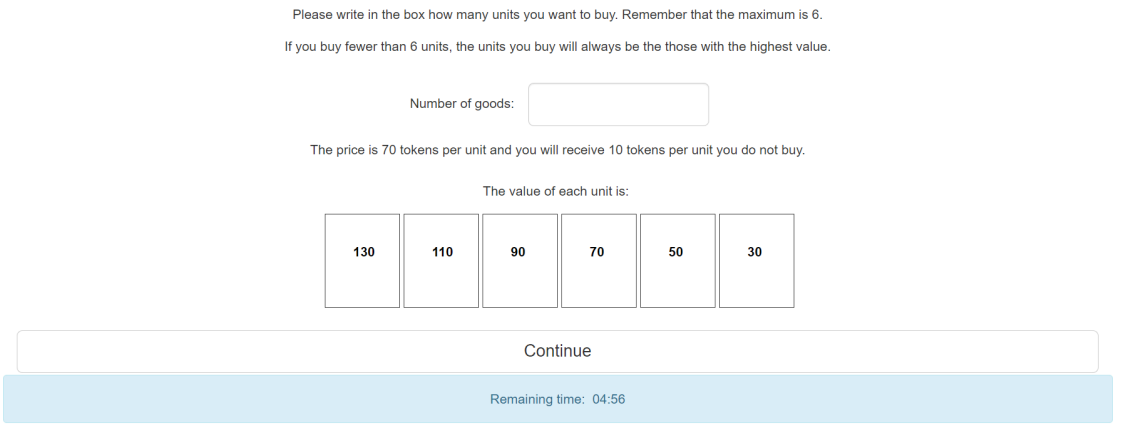
G.3.4 Open text question, 75% tax & 25% subsidy treatment group



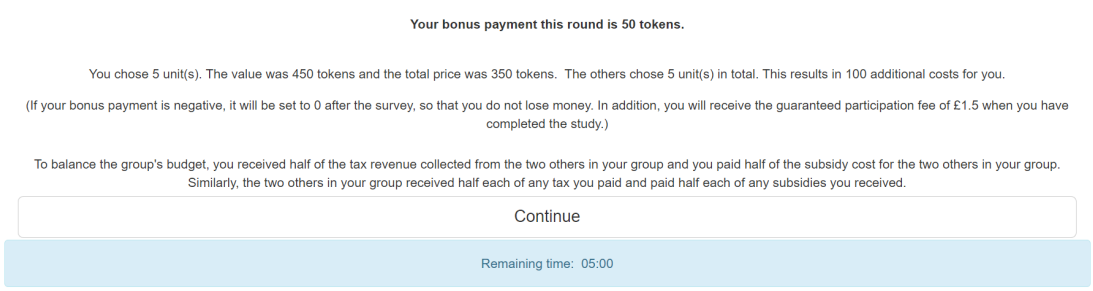
G.3.5 Result from voting, 75% tax & 25% subsidy treatment group



G.3.6 Purchase of goods part 2, 75% tax & 25% subsidy treatment group



G.3.7 Result bonus payment part 2, 75% tax & 25% subsidy treatment group



G.4 If a majority in the group do not vote for a policy change