Garnering support for Pigouvian tax with revenue earmarking: a lab experiment

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Resumo
Objetivando-se verificar se a vinculação da receita tributária aumentaria a aceitação do imposto Pigouviano de maneira eficaz e eficiente, foi realizado um experimento de laboratório envolvendo a geração de externalidade negativa. Três tratamentos foram aplicados diferindo em proporção da receita vinculada à transferência de renda. O trade-off entre eficiência e aceitação previsto pela teoria se mostrou empíricamente compatível com um aumento da aceitação em 81 pontos percentuais e da eficiência em 14 pontos experimentais, sob 50% de vinculação. No entanto, o aumento da vinculação para 80% resultou em menor aceitação e eficiência, devido, provavelmente, à expectativa dos participantes de um pequeno impacto na externalidade gerada pelos demais participantes. A vinculação revelou-se, pois, socialmente justificada, mas apenas de maneira limitada, desafiando o consenso emergente na literatura experimental sobre a eficácia de tal dispositivo. Adicionalmente, foi refutada a hipótese de votação racional, o que aponta para a necessidade de mais pesquisa quanto ao modelo comportamental efetivo, como insumo para o desenho de um mecanismo de incentivo à aceitação embasado na vinculação.

Palavras-chave: imposto Pigouviano, experimento de laboratório, vinculação de receita tributária.

Abstract
To test if tax revenue earmarking can increase Pigouvian tax acceptance effectively and efficiently, a laboratory experiment with negative externalities was conducted. Three treatments were applied as shares of revenue earmarked as cash transfer. The acceptance-efficiency trade-off predicted by theory proved empirically compatible with an increase in acceptance of 81 percentage points and of 14 experimental points in efficiency, with 50% revenue earmarking. However, a further increase to 80% earmarking resulted in lower acceptance and efficiency, due, probably, to participants expecting the tax to have a small effect on the externality generated by the other participants. Earmarking thus proved socially justified but only in a limited extent, defying the emerging consensus in experimental literature on the device’s effectiveness. Also, rational voting was refuted, what calls for more research to unveil the actual behavioural model, as input to design an earmarking-based mechanism to incentivize acceptance.

Keywords: Pigouvian tax, laboratory experiment, earmarking.

JEL Codes: H23, C92, Q58.

Área ANPEC 11 - Economia Agrícola e do Meio Ambiente
1 Introduction

Theoretically, the Pigouvian tax, once introduced with the correct rate, would automatically lead society to the socially optimal level of negative externality (Ballard, 1993, Baumol and Oates, 1988, chap. 3). The policy is also desirable for generating tax revenue as a “second dividend” (Baumol and Oates, 1988; Perman et al., 2003, chap.7). However, in practice, over the previous few decades, there has been great opposition to Pigouvian taxation by both the private sector and the general public. Kallbekken and Saelen (2011) list examples of unsuccessful attempts to introduce the tax, including the carbon taxation in France in 2010, and, again, in 2018 (Douenne, 2018) with the “gilets jaune” demonstrations, road pricing in congested roads in Scotland in 2005, taxation of fossil fuels in Switzerland in 2000, the fuel tax escalator in the United Kingdom in 2000 and energy taxation in the USA in 1993. Added to this list is the repeal of the carbon tax in Australia in 2014 (Australian government, 2014).

Earmarking tax revenue to specific expenditures could potentially increase acceptance (Kallbekken et al., 2011, Saelen e Kallbekken, 2011 and Gevrek e Uyduranoglu, 2015). Eklund (1969) argues that earmarking uncovers the link between tax payments and the return in terms of public goods and services. However, from a potentially positive “acceptance-effect” of earmarking in the general case, one should not conclude on its efficiency whether applied, specifically, to a Pigouvian tax. In fact, if who pays the tax also receives the benefit resulting from revenue expenditure, the incentive to reduce externalities is dampened. There is, then, an “efficiency-effect”, so that the Pigouvian-tax-earmarking combination is intrinsically prone to a trade-off between public acceptance and implementation of the efficient externality level. This study aims to investigate such a trade-off and measure the acceptance and efficiency effects, checking whether and in which extent it is possible to increase acceptance without sacrificing efficiency.

The trade-off in question was ignored by previous studies advocating earmarking as a means for higher acceptance of the Pigouvian tax. In Kallbekken et al. (2011), the transfer of revenue to a specific social group proved to be effective in increasing acceptance. The authors, however, did not investigate the efficiency implications of such form of earmarking. The same is true for other studies exploring alternative paths for greater acceptance (Heres et al. 2017, Saelen and Kallbekken, 2011, Gevrek and Uyduranoglu, 2015). An exception, although not focussing on earmarking, is Cherry et al. (2012), who found, in a laboratory experiment, greater acceptance for a partial and, thus, inefficient, tax rate. Literature is also silent on the effect of different degrees of earmarking, as only the dichotomy of presence or absence of earmarking was evaluated.

Seeking to fill the gaps mentioned, we measured the causal effect of earmarking on acceptance and efficiency with a laboratory experiment. Participants, by buying and re-selling, created external damage to each other. They also voted to introduce or not a tax on purchases. The treatments applied corresponded to the degree of earmarking measured as the fraction of tax returned directly to the taxpayer. As this recycling scheme increased profits and implied a reduced tax rate, the acceptance-efficiency trade-off was introduced by design. A theoretical model informed the selection of the treatment levels and hypotheses tested.

Among the three treatments experimented, zero, 50% and 80% earmarking, the latter two resulted in a positive acceptance effect when compared to zero, considering only the first stage of experiment in which voting was enabled. However, the same was not true for the upgrade of 50% to 80%, which was probably due to the expectation, formed by participants, of a weaker tax effect on damage at a low tax rate. The efficiency effect was positive for 50% but for 80% earmarking. In addition, the hypothesis that participants optimized own quantity and expected others to also optimize was refuted, explaining differences between observed and predicted effects. Nevertheless the deviant behaviour was still coherent with the more basic principal of accounting for profit while deciding on voting.

In the next section, a review of the literature is presented together with the theoretical model basing the experiment. Methods are detailed in the third section, covering experimental procedures and data analysis.
techniques. Results and then a short discussion, linking with previous studies, follow. A brief conclusion closes the paper.

2 Theory

2.1 Literature review on the subject

The literature sustains that, overall, externality-correcting taxes are strongly opposed by the public (Cherry et al., 2017; Cherry et al., 2012; Kallbekken and Saelen, 2011; Saelen and Kallbekken, 2011, Dresner et al., 2006, Heres et al., 2017). Beyond that, Cherry et al. (2011 and 2017), detected aversion for corrective intervention in general, including subsidies and quantity regulation, which may be due to a deep-rooted understanding that intervention somehow constrains behaviour. One reason for aversion is the “valence framing effect” (Kallbekken et al., 2011), associated with the term “tax”, i.e., the perception of taxes as something always negative, as observed in some studies (Kallbekken et al., 2011, Cherry et al., 2011). Other reasons are those reported by Dresner et al. (2006), which are (i) the misunderstanding of the effects and benefits of taxes, (ii) the low confidence in the government itself and the distrust that it will make socially adequate use of tax revenue, (iii) the greater preference for subsidies and (iv) resistance to regressive taxes.

The aversion mitigation solutions that received more attention in the reviewed articles were the provision of information and clarification on the Pigouvian tax and earmarking of tax revenue. Information provision proved capable of increasing acceptance in the Spanish laboratory experiment by Heres et al. (2017). But part of this effect may be strictly explained in terms of self-interest since, in the cited paper, the information offered was useful for calculating individual return. Mere clarification, i.e., explanation without additional (valuable) information on, e.g., revenue distribution, had no effect on acceptance, even under a low understanding of how tax works, in a static-decision experiment (Kallbekken et al. 2011). However, in a case of intertemporal decision, a positive effect was found (Tiezzi and Xiao, 2016). The effect of clarification of the decision problem therefore is ambiguous and seems to depend on decision complexity.

Now, turning to earmarking, it was shown to be effective in the consulted literature (Kallbekken et al. 2011, Saelen and Kallbekken, 2011, Gevrek and Uyduranoglu, 2015, Heres et al., 2017). Saelen and Kallbekken (2011), estimated, with a choice experiment in Norway, an acceptance gain of 15%, in terms of tolerated increase in the tax rate, resulting from the earmarking of the extra funding to environmental policy. Complementing this result, a laboratory experiment with Austrian students conducted by Kallbekken et al (2011) demonstrated that earmarking considerably increases the acceptance of the Pigouvian tax. They earmarked revenue to cash transfers targeted at specific social groups and contrasted this with indiscriminate redistribution. The acceptance gain was due to the lower intra-group inequality of the resulting payoffs and it remained significant, even with great aversion and partial understanding of the tax. The finding was parallel by Heres et al. (2017), whose “full information treatment” earmarked tax revenue to income transfers, increasing acceptability of the Pigouvian tax. In focus groups with varied opinion segments of the Norwegian population, Kallbekken and Aasen (2010) detected a near-consensual stronger support for environmental taxes whose revenues were earmarked to environmental purposes, echoing Saelen in Kallbekken (2011). Similarly, the Turkish choice experiment of Gevrek and Uyduranoglu (2015) which, among the carbon tax attributes evaluated, included alternative uses for the revenue, attested strong predilection for environmental earmarking.

Despite recurrent evidence on earmarking effectiveness, it should be noted that such an effect may not be strong enough to lead to the approval, in a referendum, of the Pigouvian tax, whether alternative policies are also at stake (in the fiscal sense). In fact, Heres et al. (2017) observed, comparing fiscally equivalent Pigouvian subsidy and tax, that the former increased acceptance and expected profit in larger magnitudes, which persisted even under earmarking. Cherry et al. (2017) found Pigouvian tax to be less acceptable not only than Pigouvian subsidy, but also direct quantity regulation. Also, earmarking may sacrifice efficiency, as emphasized by public finance theory (Eklund, 1969), which draws upon fiscal inflexibility, but for a different reason. If the tax revenue generated by a small group is earmarked to cash transfers to
the same group, *a la* Kallbekken (2011), agents could anticipate the recycling as tax abatement, thus producing externality suboptimally. The latter effect was observed in the experiment of Cherry et al. (2012), for a less-than-efficient tax rate treatment, which, nevertheless, proved more acceptable to participants. In synthesis, the combination of Pigouvian tax and earmarking is potentially “toxic” as it means trading externality correction for acceptance. Notwithstanding, whether and in which extent such trade-off may be explored in a socially advantageous way remain unknown as previous studies have not touched the topic or compared different levels of earmarking. These are the gaps targeted in this paper.

### 2.2 Brief review on method

Most of the reviewed articles used laboratory experiments to measure the acceptance of Pigouvian instruments (Kallbekken et al., 2011, Heres et al., 2017, Cherry et al., 2012, Tiezzi and Xiao, 2016, Choo et al., 2016). Surveys, such as the discrete choice experiment, in which there is no interaction between participants, were also used, but mainly with the aim of identifying influential characteristics of the instruments (Kallbekken and Saelen, 2011, Gevrek and Uyduranoglu, 2015).

In the experiments, the treatments applied captured (i) nomenclature, (ii) information or clarification, (iii) type of instrument (tax or subsidy); (iv) form of earmarking (indiscriminate or targeted cash transfer, policy funding); (iv) enforcement of tax compliance; (v) lag in the damage imposed by the externality and (vi) default option, i.e., whether the policy is in effect or not at the outset. Design was most commonly between-subject and contained up to two treatments (Kallbekken et al., 2011, Cherry et al., 2011 and 2017, Tiezzi and Xiao, 2016 and Heres et al., 2017).

In the archetypical experiment, participants interacted in a market with externality arising from the task of purchase. Voting was the second task performed, being at stake the introduction or not of a tax in the subsequent rounds. The repetition of the first task in all rounds and of the second task at least once, is a standard in the literature, which eliminates anomalies as experience is accumulated (Tiezzi and Xiao, 2016, Kallbekken et al. 2011). In addition, more than one ballot allows to check whether the attitude towards tax changes after tax is experienced (Tiezzi and Xiao, 2016).

### 2.3 Theoretical model

#### 2.3.1 Quantity decision

Based on the previous subsections a theoretical model is here detailed, building upon Heres et al. (2017). The authors recycled revenue in two ways. First, as an earmarked cash transfer, proportional to the aggregate purchased quantity. Second, as a lump-sum transfer. These two types of transfer were introduced in a disjoint manner, as different treatments. But here they are combined as complimentary expenditures of the same Pigouvian tax revenue, seeking to measure the effect of the degree of earmarking (and not of earmarking presence or absence, as in the original paper). Such degree would take the form of the share of earmarked transfer in the total transfer. More precisely, the two types of transfer are:

1. Earmarked transfer: in Heres et al. (2017), it corresponds to the equitable division of the aggregate tax revenue, that is, all participants in the interaction group (market) receive the same transfer. In order to have an earmarking which is more direct, predictable - i.e., not subjected to others’ actions -, and easy to calculate, here the transfer is a fraction strictly of the own-tax paid;

2. Lump-sum transfer: its precise level and its underlying calculation are unknown to participants. It consists in the equitable distribution of aggregate revenue not returned as earmarked transfer.

Incorporating the two forms of transfer in an algebraic version of the model by Heres et al. (2017), the individual profit function is:

\[
\pi(q) = v(q) - pq - \tau q + L - \beta Q \tag{1. a}
\]

\[
L = L_1 + \bar{L}_2 \tag{1. b}
\]

\[
L_1 = \varepsilon \tau q \tag{1. c}
\]
Where “q” is quantity purchased, “ν(.)” is the resale value function capturing agents’ purchase benefit, “p” is the purchase price, “τ” is the tax rate, “β” is the marginal (private) damage from externality and “Q” the total amount purchased by other agents. The total transfer received, “L”, splits up into earmarked, “L₁” and lump-sum, “L₂”. The degree of earmarking is denoted by “ε”.

The function simplifies to:

$$\pi(q) = \nu(q) - (p + \tau(1 - \varepsilon))q + L_2 - \beta \tilde{Q} \quad (1')$$

The first order condition is $\nu'(q) = p + \tau(1 - \varepsilon)$. For $\varepsilon = 1$, tax is absent and the agent chooses the privately optimal quantity. For $\varepsilon = 0$, full tax rate applies and the agent chooses the socially optimal quantity. For $0 < \varepsilon < 1$, there is earmarking and an intermediate and inefficient quantity prevails; such is the source of earmarking inefficiency in the model.

The governmental planner has complete information about the damage and the two forms of transfer, so that, with “i” indexing agents, the social surplus function is:

$$\Pi = \sum_{i=1}^{N} \{\nu(q_i) - (p + \tau)q_i + L_i - \beta Q_i\} \quad (2. a)$$

$$L_i = \varepsilon \tau q_i + \frac{1}{N} \left( \sum_{i=1}^{N} (1 - \varepsilon) \tau q_i \right) \quad (2. b)$$

$$Q_i = \sum_{k \neq i}^{N} q_k = \sum_{i=1}^{N} q_i - q_i \quad (2. c)$$

Each agent, thus, receives a transfer unfolding into a proportion of its own revenue and an equitable share of the non-recycled aggregate tax revenue. Regarding this, it should be noted that:

$$\sum_{i=1}^{N} L_i = \sum_{i=1}^{N} \left( \varepsilon \tau q_i + \frac{(1 - \varepsilon)\tau}{N} \left( \sum_{i=1}^{N} q_i \right) \right) = \sum_{i=1}^{N} \varepsilon \tau q_i + \frac{N}{N} \left( \sum_{i=1}^{N} q_i \right) = \tau \sum_{i=1}^{N} q_i \quad (2. b')$$

So that public budget is fully balanced. Merging 2.a, 2.b’ and 2.c, social surplus becomes:

$$\sum_{i=1}^{N} \pi(q_i) = \sum_{i=1}^{N} \nu(q_i) - [p + \beta(N - 1)] \sum_{i=1}^{N} q_i \quad (2''')$$

The planner must choose the quantities for all agents, and the first order condition for the i-th agent is $\nu'(q_i) = p + \beta(N-1)$. Since the function $\nu(.)$ is the same for all agents, they all acquire the same amount in the socially optimal solution. The Pigouvian tax rate is therefore $\beta(N-1)$, the marginal damage². Thus, the value function of the planner’s problem is:

$$\Pi = N [\nu(q) - [p + \beta(N - 1)]q] \quad (2''')$$

As earmarking level, $\varepsilon$, is omitted from the two previous formulas, the modification of Heres et al. (2017) here presented, and the type of earmarking here considered, are neutral in terms of social optimality. However, the private optimal quantity varies with earmarking degree, as already shown.

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1 Aggregate surplus is the measure of efficiency employed in this paper.
2 Note that, based on the private first order condition, in the absence of earmarking, this being the case for the ordinary Pigouvian tax, such rate implements, via individual decision, the socially optimal quantity.
2.3.2 Vote decision and theoretical predictions

There is an important distinction between the two experimental tasks. Whereas choosing quantity does not require accounting for others’ actions, this is needed for rational voting. In fact, introduction of the tax changes ex-post damage level and profit and thus expectation on others’ quantity should be formed. In this respect, the rational expectations assumption is particularly helpful in regards to reducing the number of theoretical predictions - the seven levels of quantity result into 49 combinations of others’ quantities in the states with and without tax. It is thus assumed that not only participants choose own quantity optimally but also that they expect the others to do the same, and this procedure is applied to the states with and without tax. What will be hereafter referred as rational voting hypothesis (RVH). The expectation formation component of the hypothesis is coherent with the fact that the decision problem faced by all participants is the same. Considering the private and social payoff functions under RVH, as well as the adapted\(^3\) parametric levels of Heres et al. (2017), table 1 provides the basis for predictions of the acceptance and efficiency effects.

Table 1 Value functions and optimal quantities, private (rational) and social perspectives

<table>
<thead>
<tr>
<th>Earmarking</th>
<th>(\Pi/N^a)</th>
<th>(\pi_{\text{res}}^b)</th>
<th>(\pi_{\text{res}} - E[D]^c)</th>
<th>(\pi_{\text{res}} - E[D] + T^d)</th>
<th>(q^e)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 45%</td>
<td>44</td>
<td>44 to 71 (↑)</td>
<td>-16 to 11 (↑)</td>
<td>44</td>
<td>3</td>
</tr>
<tr>
<td>50 to 60%</td>
<td>44</td>
<td>74 to 80 (↑)</td>
<td>14 to 20 (↑)</td>
<td>44</td>
<td>3</td>
</tr>
<tr>
<td>65% to 75%</td>
<td>44</td>
<td>84 to 92 (↑)</td>
<td>4 to 12 (↑)</td>
<td>32</td>
<td>4</td>
</tr>
<tr>
<td>80% to 90%</td>
<td>44</td>
<td>96 to 104 (↑)</td>
<td>16 to 24 (↑)</td>
<td>32</td>
<td>4</td>
</tr>
<tr>
<td>95% to 100%</td>
<td>44</td>
<td>109 to 114 (↑)</td>
<td>9 to 14 (↑)</td>
<td>14</td>
<td>5</td>
</tr>
<tr>
<td>No tax</td>
<td>14</td>
<td>114</td>
<td>14</td>
<td>NA</td>
<td>5</td>
</tr>
</tbody>
</table>

Note: \(a\) average socially optimal profit per capita from the planners’ problem; \(b\) individual resale profit (resale value - resale price + earmarked transfer); The symbol "↑" indicates that profit increases with earmarking level, within the specific earmarking interval; \(c\) individual resale profit after expected damage \((E[D])\), under RVH; \(d\) individual profit after damage and lump-sum transfer, which is known by agents only a posteriori; this is the profit basing calculation of efficiency; \(e\) privately optimal quantity.

The voting decision can be understood under the light of the profit functions (section 2.3.1), table 1 and a two-stage procedure. In the first stage, the agent calculates optimal quantity for states with and without tax and, in the second, s/he votes in the state maximizing profit. The relevant measure of profit is the fourth column of table 1. Based on it, the theoretical predictions are that, both 50% and 80% earmarking induce a positive acceptance effect, which should be weaker for the former as it leaves agent indifferent between voting for or against the tax. Regarding efficiency effect, the proper measure is total profit, also with lump-sum transfer, in the fifth column. The predictions are that 50% and 80% also both increase efficiency, the former in a larger amount.

\(^3\) Only parameter \(\beta\) was altered, from $3 to $5.
3 Method

3.1 Hypothesis to be tested

Summarizing the theoretical section, the following hypotheses were tested:

H1.0: earmarking does not affect voting.

H1.1: earmarking affects voting with positive effects under 50% earmarking and a larger positive effect under 80% earmarking

The second hypotheses test builds on P2:

H2.0: the same level of efficiency is achieved irrespective of the degree of earmarking.

H2.1: efficiency is larger under 80% earmarking and even larger under 50% earmarking.

3.2 The experiment

3.2.1 Setup and treatments

The experiment consists of a highly simplified market with fixed-price purchases à la Heres et al. (2017) and referendum voting for the introduction of a tax. Such design is standard in experiments on Pigouvian tax acceptance (Tiezzi and Xiao, 2016, Kallbekken et al. 2011, Heres et al., 2017 and Cherry et al., 2012). Participants choose, in each of 20 rounds, how many units of a good to purchase and this quantity is automatically resold at the end of the period. The decision problem reduces to picking the quantity that maximizes resale profit and voting in the best option.

The currency, “experimental points”, is denoted by “ES$. A market involves 5 participants with each unit purchased generating a damage of (β =) ES$5 per capita, impacting only the other participants of the market (but not oneself). The damage is deducted from profit at the end of each round. The purchase price “p” is fixed at ES$26, and the resale value of the last unit is fixed and decreasing according with a numeric function, v’(q). Profit is calculated as detailed in section 2.3.1, with τ = 0 in tax-free rounds. At the beginning of rounds 11 and 16, it is voted whether a “fee” will be in vigour in the own round and in the next 4 rounds. The term “tax” is omitted in order to avoid the valence framing effect (Kallbekken et al., 2011, Cherry et al., 2011), and earmarking is referred as “fee return”, being added to profit at the end of each round.

Three levels of earmarking were applied as treatments. They were chosen based on the individual profit function (section 2.3.1), taking values of ε in the [0; 1] interval separated by increments of 5 percentage points, in order to obtain profit levels saliently different at participants’ eyes. The chosen levels were:

1. ε = 0 or no earmarking. This is the ordinary Pigouvian tax, with fully efficient tax rate. In this treatment, tax introduction decreases profit;
2. ε = 50%. This is half the efficient tax rate and the only level of earmarking in which tax is profit-neutral, i.e., its introduction does not change profit;
3. ε = 80%. Here, with 20% of the efficient tax rate, profit is increased by tax introduction. Let the reason for selection of the 80% level be clarified. As shown in table 1, the profit differential with and without tax peaks at ε = 90%, however, at this level the optimum quantity is ambiguous, as both 4 and 5 units generate the same profit. This was also true for the lower peak at ε = 60%. Among the other

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4 The values are, “(…) from the first to the sixth unit, 76, 60, 46, 34, 28, and 24 [experimental points] (Heres et al., 2017)”.

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three levels of ε with tax superiority in profit, 55% was discarded for being too close to 50% (the neutral level), and 85%, for resulting in fractional profit and tax numbers, making calculation harder for participants. Hence the option for ε = 80%, the only remaining level with individual tax superiority. This was also one of the few levels considerably different from 50% in which tax superiority in profit was achieved with a minimally salient difference in profit (E$2) between the optimum quantity (4) and immediately inferior and superior quantities (3 and 5).

3.2.2 Structure

Treatments were randomly assigned to sessions. In the beginning of each session, participants were randomly assigned to two groups of 5 individuals each (“markets”) who interacted through computer terminals. The groups remained the same until the end of the session as in Tiezzi and Xiao (2016). Each experimental session comprised 20 rounds distributed in three stages, initiated by a trial stage with 10 rounds, followed by two stages, each starting with a ballot and comprising 5 rounds, as shown in Figure 1. Stage 1 allowed learning about quantity decision, as common in the papers taken as basis (eg, Tiezzi and Xiao, 2016).

Figure 1 – Experiment’s timeline

The experiment started with the presentation of instructions5, comprising (i) self-reading in 10 minutes; (ii) a reading aloud in approximately 5 minutes and, (iii) the filling of a written quiz form, including profit calculation exercises, in 7 minutes. Right after voting, and before knowing the ballot’s result, participants answered four questions related to the quantity they planned to choose and the quantity they expected each group mate to choose, with or without tax in both cases. Participants were initially informed about the first ballot, but not about the second (as in Tiezzi and Xiao, 2016). At the end of the experiment, a questionnaire was applied including 13 questions on personal characteristics and 6 extra debriefing questions on how vote was decided and how expectations on others’ quantities were formed. Payment was based in a randomly selected round from stages 2 and 3, whose profit was converted into Brazilian currency, “Reais” or “R$”, with a R$1/E$2 ratio, and added to the participation fee of R$10 (as in Smith and Day, 2017). Negative converted profits were zeroed so that no participant earned less than R$10.

The experiment was implemented with undergraduate students of the Federal University of ABC, in São Paulo state, Brazil, in October and November 2019. Economics students were not recruited to avoid theoretical knowledge bias. The “z-Tree” software (Fischbacher, 2007) was used to program and run the experiment, including the questionnaire. At the end, data were collected from 160 participants, divided into 16 sessions with 10 participants each. Treatments zero and 50% were applied in five sessions each and treatment 80% in six sessions.

5 Instructions are available in the following link: https://docs.google.com/viewer?a=v&pid=sites&srcid=ZGVmYXVsdGRvbWFpbnxmb25zZWNhbW9yZWhsb3xeDo1ODY1NTA1ZDE4Zml4Y1Nh
3.3 Data analysis

The hypotheses stated in section 3.1 were tested with mean and proportion difference parametric tests, at section-stage and participant-stage level. Additionally, the conditional acceptance effect was modelled as follows:

\[ P(Y=1|X) = G(a_0 + a_1d_{50} + a_2d_{80} + a_3\mu + a_3\text{opt} + X\beta + D\delta) \]

With \( d_{50} \) and \( d_{80} \) denoting, with unitary value the 50% and 80% treatments, \( \mu \), a measure of importance of profit in the voting decision (as stated in the questionnaire), “opt” the number of periods of the stage in which (self) quantity was optimized and \( X \), a vector of personal characteristics and \( D \), a vector with session dummies. A second version of the model, replacing 50% treatment dummy for a zero treatment dummy was also estimated to measure the conditional effect of an increase in earmarking from 50% to 80%. The model was estimated at the participant-stage level, separately for each ballot round (as in Tiezzi and Xiao, 2016). Estimation of the conditional acceptance effect required, due to the non-linearity of probability models and the binary nature of the earmarking variables, all respondents to be shifted from a baseline to an alternative earmarking level (all the other variables were kept unchanged). The difference in the predicted probability, averaged across respondents, was taken as the envisaged effect. The same covariate set, except for the first ballot vote, was used in linear regressions explaining average profit in the 2nd and 3rd stages. These were meant to be participant-level conditional tests of the efficiency effect.

4 Results

4.1 Optimization and beliefs

A score in the quiz below 80% was deemed as unsatisfactory understanding of the experiment most elementary task, profit calculation, with such cases being excluded from data analysis. Results that follow are thus based in a dataset with 103 respondents.

The theory laid out in section 3 above has two main assumptions, (i) that voters optimize quantity and (ii) that voters expected other voters in the same interaction group to optimize quantity. If these two assumptions were verified by the experiment, then voting decision should follow theory, i.e., pro-voting should increase with earmarking. In regards to the first criterion, optimization was not dominant, totaling 47% of respondents across the paid periods (second and third stages), with a 37% rate of suboptimization in one unit of quantity. Thus, the learning observed in the unpaid period (figure 2) was not enough to lead to fully accurate quantity choice. The highly frequent one unit mistake was material under the 80% treatment, in which optimal quantities with and without tax differed in exactly one unit. Also, in this same treatment level, a one unit difference in expected others’ quantity would change the optimal vote from favourable to unfavourable (whether others’ were assumed to choose, e.g., five, instead of the optimal four units). This suggests suboptimization of voting was frequent under 80% earmarking. Variation of quantity across periods of the second and third stages was not large, with the stage-specific coefficient of variation of 47% and 63% for the second and third stages, respectively.

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6 A dummy for whether group mates were expected to optimize was omitted to avoid losing scarce degrees of freedom as a relevant fraction of participants (47% and 37% in the first and second ballots) provided unreliable responses to questions regarding expectations.

7 As all covariates were time-invariant, a panel data analysis was unfeasible.

8 Other refinement options either eliminated too much observations (100% score = 101 out of 160 eliminated) or were too permissive in regards to misunderstanding (60% = three out of five questions right, 40% = two out of five question, 20% = one out of five question).
Figure 2 – Learning about quantity choice (solid line = average participant, thick solid line = median participant, dashed line = participants at 25th and 75th percentiles)*

*Independence of period and a dichotomous optimization variable was rejected at 0.5% significance. All participants were considered (not only those with 80% quiz score).

Now considering expectation formation, stating an expected individual quantity for other group mates exactly matching the optimal was not dominant in any of the two occasions the question was posed (after the first and second ballots), as shown in table 2 below.

Table 2  Rate of optimization-based expectations among participants with reliable statements*

<table>
<thead>
<tr>
<th>Ballot</th>
<th>Did not expect others would optimize</th>
<th>Did not optimize or did not expect others would optimize</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No tax</td>
<td>Tax</td>
</tr>
<tr>
<td>1st</td>
<td>33.3%</td>
<td>29.6%</td>
</tr>
<tr>
<td>2nd</td>
<td>51.6%</td>
<td>50.0%</td>
</tr>
</tbody>
</table>

* Only reliable statements were considered. Reliability was assessed based on another question asked together with the question on others’ expected quantity, which referred to the own quantity that participants planned to choose with or without tax. Only whether the statement was, afterwards matched by the median quantity actually practiced, participants were deemed reliable in regards to others’ expected quantity. Reliability rate was of 53% and 63%, respectively, in the first and second ballots.

In summary, the majority of the participants either did not optimize or did not assumed their group mates would do, which means RVH was followed by the minority (table 2). Therefore, the observed acceptance and efficiency effects may deviate from theory, a matter treated in the next sections.

4.2 Acceptance-effect

The results of acceptance tests were not in fully accordance with the pattern suggested by RVH of monotonic increase of pro-vote with earmarking. In the first ballot, positive earmarking increased voting,
which matches theory, but 80% earmarking decreased acceptance as compared to 50% (Table 3). This could be due to the one unit quantity suboptimization distorting optimal voting under the 80% treatment. In the second ballot, no acceptance effect was found with voting rates across treatments being statistically equal, a radical departure from RVH (table 3). Comparing first and second ballot, vote replication rate ranged from 71% to 76% across the three treatments, with a statistically significant shift from anti to pro vote under zero earmarking (Table 4). The opposite shift under 50% earmarking was weakly significant.

Table 3  Acceptance tests

<table>
<thead>
<tr>
<th>Treatments compared</th>
<th>First ballot</th>
<th>Second ballot</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Voting rates</td>
<td>Sample size</td>
</tr>
<tr>
<td>0 vs 50%</td>
<td>19% vs 68%*</td>
<td>ε = 0: 32, ε = 50%: 34</td>
</tr>
<tr>
<td>0 vs 80%</td>
<td>19% vs 41%*</td>
<td>ε = 0: 32, ε = 80%: 37</td>
</tr>
<tr>
<td>50% vs 80%</td>
<td>68% vs 41%*</td>
<td>ε = 50%: 34, ε = 80%: 37</td>
</tr>
</tbody>
</table>

Significance at 5% or lower is denoted with “*”.

Table 4  Vote change by treatment

<table>
<thead>
<tr>
<th>Ear. = 0</th>
<th>Ear. = 50%</th>
<th>Ear. = 80%</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>56.25%</td>
<td>25%*</td>
</tr>
<tr>
<td>Yes</td>
<td>0</td>
<td>18.75%</td>
</tr>
</tbody>
</table>

OBS: to test for significance of the difference of paired proportions, McNemar (1947) chi-square test and Agresti and Min (2004) standard normal tests were applied (Lu, 2010). Significance at 5% in the two tests is indicated with “*” and in only one test with “+”.

4.3 Efficiency-effect test

Table 5 presents a hypotheses test at respondent level for individual profit averaged across all periods of second or third stages. In the former, an inverted U relationship between earmarking and efficiency prevailed, with 50% above both zero and 80% and no difference between the latter two treatments. In the third stage, no efficiency effect was found, with 80% exhibiting a lower level of earmarking. Damage level was smaller in the 50% treatment, which was not expected according with RVH in table 1 (the damage test is omitted to save space).
<table>
<thead>
<tr>
<th>Treatments compared</th>
<th>First ballot</th>
<th>Second ballot</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean profit</td>
<td>Sample size</td>
</tr>
<tr>
<td>0 vs 50%</td>
<td>23 vs 31*</td>
<td>ε = 0: 32,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ε = 50%: 34</td>
</tr>
<tr>
<td>0 vs 80%</td>
<td>23 vs 20</td>
<td>ε = 0: 32,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ε = 80%: 37</td>
</tr>
<tr>
<td>50% vs 80%</td>
<td>31 vs 20*</td>
<td>ε = 50%: 34,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ε = 80%: 37</td>
</tr>
</tbody>
</table>

4.4 Econometric analysis

The variables of the econometric model are summarized in Table 6, except for session dummies⁹. Fine screen television is a proxy for household income, as informed by the Brazilian Household survey (21% correlation, p-value < 0.01; IBGE, 2016). Balanced sample mean and proportion difference tests revealed satisfactory balance, except for degree, residency location, first ballot voting, and whether voting was based on others’ quantity and own profit. This demonstrates the empirical rationale for the conditional analysis.

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⁹ Detailed estimation results are found in the following link: https://docs.google.com/viewer?a=v&pid=sites&srcid=ZGVmYXVsdGRvbWFpbnxmb25zZWNhbW9yZWxs3xneDozMmQyNWJkMjMxNTU4MTY3
Table 6 – Statistical summary of the econometric model variables

<table>
<thead>
<tr>
<th>Name</th>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
<th>Balanced sample test (p-values)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0 vs 50%</td>
</tr>
<tr>
<td>Profit (stage average)</td>
<td>aprof_ag</td>
<td>25.29</td>
<td>10.77</td>
<td>-17.8</td>
<td>45.8</td>
<td></td>
</tr>
<tr>
<td>Vote</td>
<td>vote_tax</td>
<td>0.46</td>
<td>0.50</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>50% treatment</td>
<td>d_50</td>
<td>0.33</td>
<td>0.47</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>80% treatment</td>
<td>d_80</td>
<td>0.36</td>
<td>0.48</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Zero treatment</td>
<td>d_0</td>
<td>0.31</td>
<td>0.46</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Number of periods optimizing quantity (state total)</td>
<td>t_q_ag</td>
<td>2.35</td>
<td>1.78</td>
<td>0</td>
<td>5</td>
<td>31.5%</td>
</tr>
<tr>
<td>Degree: Engineering</td>
<td>d_eng</td>
<td>0.60</td>
<td>0.49</td>
<td>0</td>
<td>1</td>
<td>15.6%</td>
</tr>
<tr>
<td>Degree: computer science</td>
<td>d_comp</td>
<td>0.14</td>
<td>0.34</td>
<td>0</td>
<td>1</td>
<td>10.1%</td>
</tr>
<tr>
<td>Evening college</td>
<td>d_noturno</td>
<td>0.68</td>
<td>0.47</td>
<td>0</td>
<td>1</td>
<td>8.5%</td>
</tr>
<tr>
<td>Residency and college town differ</td>
<td>d_outra_cidade</td>
<td>0.47</td>
<td>0.50</td>
<td>0</td>
<td>1</td>
<td>8.8%</td>
</tr>
<tr>
<td>Number of fine screen televisions</td>
<td>tv_telafina</td>
<td>1.60</td>
<td>0.91</td>
<td>0</td>
<td>4</td>
<td>54.9%</td>
</tr>
<tr>
<td>Vote in the first ballot</td>
<td>vote_tax_1st</td>
<td>0.43</td>
<td>0.50</td>
<td>0</td>
<td>1</td>
<td>0.0%</td>
</tr>
<tr>
<td>Attempted to estimate others’ quantities?</td>
<td>d_estimou</td>
<td>0.97</td>
<td>0.17</td>
<td>0</td>
<td>1</td>
<td>95.1%</td>
</tr>
<tr>
<td>Estimated others quantities to be equal to own best quantity?</td>
<td>d_estimou_sim</td>
<td>0.46</td>
<td>0.50</td>
<td>0</td>
<td>1</td>
<td>76.5%</td>
</tr>
<tr>
<td>Decided how to vote by thinking in the quantities the others would choose</td>
<td>d_voto_q</td>
<td>0.82</td>
<td>0.39</td>
<td>0</td>
<td>1</td>
<td>71.2%</td>
</tr>
<tr>
<td>Decided how to vote by thinking in own profit</td>
<td>d_voto_l</td>
<td>0.94</td>
<td>0.23</td>
<td>0</td>
<td>1</td>
<td>0.1%</td>
</tr>
<tr>
<td>Proportion in which voting decision was based on own profit with and without tax</td>
<td>exp_voto_pct_lucro</td>
<td>0.84</td>
<td>0.16</td>
<td>0.3</td>
<td>1</td>
<td>61.3%</td>
</tr>
<tr>
<td>Assumed others would choose own best quantity</td>
<td>d_mesma_q</td>
<td>0.63</td>
<td>0.48</td>
<td>0</td>
<td>1</td>
<td>17.7%</td>
</tr>
</tbody>
</table>

Notes: observations amounted to 103 at each ballot/stage. a Profit and number of periods optimizing quantity are the averages across second and third stages. b This question which was part of the survey applied after the experiment, was based in a five point Likert scale of agreement with a statement. The binary variable captures either partial or total agreement. The statement was “I decided how to vote thinking in the quantities the other members of the group would select with and without tax”. c Similarly as the previous note, the statement was “I decided how to vote thinking in the profit I would obtain with and without tax”. d The statement was “During most of the experiment I assumed the other members of the group would choose the same quantity I judged best to me.”

4.4.1 Acceptance effect

Regarding the regressions for the acceptance effect, the same results of unconditional voting tests were achieved in the first ballot, with acceptance increasing with positive earmarking but not monotonically, as 50% outperformed 80%. The second ballot returned different results, with no effect of earmarking and lower acceptance in the 50% treatment as compared with 80% (figure 3). Neither quantity optimization nor importance attached to profit while voting was influential on voting. No respondent-specific variable was systematically significant across specifications and ballots. Session
effects were detected in the two ballots, attesting influence of unobserved characteristics of respondents. The propensity to repeat voting in the second ballot (table 4 above) was confirmed by a significant first ballot vote covariate.

The conditional acceptance effect of earmarking (figure 3 below) at least doubled the unconditional effect suggested by the proportion difference (table 3 above; except for the 0 vs 80% case which was nearly the same). The effect found for 50% earmarking, of 81 percent points, is great enough to suggest such option deserves to be seriously considered for implementation. But this is not the case whether the public is given the option of experiencing the tax, as the zero effect of 50% earmarking in the second ballot revealed. Notwithstanding, evidence of tax experience effect was ambiguous as the shift from 50% to 80% earmarking decreased acceptance in the first ballot approximately by the same magnitude it increased in the second ballot.

**Figure 3**  Acceptance effects, conditional on respondents’ and sessions’ characteristics

![Acceptance effects, conditional on respondents’ and sessions’ characteristics](image)

Note: zero effects are omitted (the case for 0 vs 50% and 0 vs 80% in the second ballot).

### 4.4.2 Efficiency effect

In total consonance with the unconditional analysis, in the first ballot, 50% treatment improved efficiency above the zero baseline. The 80% either had no effect on efficiency if compared with zero or decreased it, if compared with 50%. Now in the second ballot, 50% has not increased efficiency upon zero and 80% reduced both as compared with 50% but also - in disagreement with unconditional analysis on statistical significance but not on numerical difference - when contrasted with zero treatment. The magnitudes of the effects were also larger than the conditional mean differences (figure 4). Taking zero earmarking as basis, 50% increased efficiency in 14 experimental points in the first ballot (56% of the average) and 80% decreased in 17 points in the second ballot (67% of the average).{\textsuperscript{10}}

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\textsuperscript{10} An alternative battery of regressions was estimated for the second ballot, with second stage profit in place of first ballot vote. The results were qualitatively equal but quantitatively smaller in absolute magnitude in regards to the depressing effect of 80%. For conservativeness, only the regressions with first ballot vote are accounted for in this text.
5 Discussion

5.1 Earmarking effect without assuming rational voting

To properly understand the deviations of acceptance and efficiency effects from predictions based in the rational voting hypothesis the (individual) profit differential with and without tax was computed. This was done for 315 combinations of levels of three variables, own quantity with tax, own quantity without tax and expected difference of others’ aggregate quantity with and without tax. The first two variables were assumed to vary in the proximity of the specific optimal quantity in at most one and two units, respectively, with a greater range assumed for the case with tax due to the greater intricacy of the optimization calculation (and also because there was no tax in the training stage). Of course, the own quantity levels do not exhaust all possibilities, but are a reasonable selection accounting for the trend to suboptimize by one unit (section 4.1 above). The whole range (0 to 6) of expected decay in others’ quantity was considered - for a given point in the horizontal axis, different points in the vertical axis represent different with vs without tax discrepancies of own quantity. The associated profit differential levels are shown in figure 5 and whether positive, pro-voting is best. It is also visible in the figure combinations of the four quantities that were stated by participants in the ballots and matched effective behaviour after ballots strictly in terms of own quantity, thus being credible possibilities (coloured dots). These combinations were converted into the respective profit levels without the lump-sum transfer.

The graphs demonstrate that behaviour deviating from the rational voting hypothesis was reasonable. With zero earmarking, tax was mostly profitable for an expected reduction of above three units and with 80% earmarking, tax was mostly unprofitable for less than two units. In all treatments, tax was not profitable with zero expected reduction and it was profitable with expected reduction of 5 units or above. Taking zero in the vertical axis as the reference, it is clear that the 50% treatment was the most mixed case, which is consonant to the indifference between pro and anti-vote under the rational voting hypothesis. Based on the theoretical points, the most coherent explanation for the lower acceptance under 80% earmarking if compared with 50% is that participants under 80% were more prone to expect a low to null effect of tax on others’ quantities and thus on the damage absorbed. Therefore, it may be that earmarking altered agents’ expectations about tax effectiveness. This explanation adhered to the observed combinations plotted in figure 5. First, under 80% earmarking, the expectation that the tax would not only left others’ quantities unchanged but could even increase it, was more frequent (21% rather than 18% and 15% under zero and 50% earmarking, respectively). Now, taking the possibility of tax “back-firing”, i.e.,
ignoring zero tax effect, a clearer pattern of relationship with earmarking is observed, with frequencies of 6%, 9% and 12%, respectively, from zero to 80% earmarking. This is a sharpen evidence of the propensity to believe that the effectiveness of the tax as an externality correction instrument would decrease with earmarking.

**Figure 5**  Profit differential of pro-tax vote for different levels of own quantity with and without tax and of expected decay on others’ aggregate quantity (deviations and non-deviations from rational voting hypothesis are denoted, respectively, with empty and full black circles; observed combinations in the first ballot coloured red and purple for second ballot).

Note: each line is a different combination of own quantity with and without tax, whose values are \(\{q^*-1, q^*, q^*+1\}\), in the case of the former and \(\{q^*-2, q^*-1, q^*, q^*+1, q^*+2\}\), and for the latter, \(q^*\) being a particular optimal quantity. The function behind the graphs is \(\Delta \pi = -v(q_{no\_tax}) + v(q_{tax}) - \tau(1 - \varepsilon)q_{tax} + p(q_{no\_tax} - q_{tax}) + \beta(\Delta E[Q])\), with best quantity with and without tax denoted by “q_no_tax” and “q_tax” and expected decay in others’ quantity by \(\Delta E[Q]\).

### 5.2 Acceptance and efficiency effect in previous studies

The acceptance-effect of 50% earmarking is in line with previous studies of Pigouvian tax acceptance. Kallbekken et al. (2011), found, with a laboratory experiment, greater acceptance of the tax under targeted (earmarked) revenue redistribution. With the same method, Heres et al. (2017) observed that informing participants that tax revenue would be uniformly transferred raised support for the tax. Saelen and Kallbekken (2011), found that earmarking to environmental policy increased acceptance of fuel tax, based on a choice experiment. This method also supported the evidence by Gevrek and Uyduranoglu (2015) that carbon tax was more attractive with earmarking.

The relevant topic of earmarking efficiency was not investigated by previous studies, with the exception, perhaps, of Cherry et al. (2012), a study, which, however, did not aimed to measure the earmarking effect. It should be noted that, in our experiment, the effect of earmarking on efficiency occurs through (i) the
reduction in the full resale price, which includes the tax, and, therefore, an increase in resale profit and, (ii) the increase in damage, which occurs only when quantity augments. This second effect was also observed in Cherry et al. (2012 and 2017), as, in the authors’ experiment, under the half tax rate profit was lower, which could only be caused by increased damage.

5.3 Rational voting refutation and research agenda

RHV, which was refuted, is only one of the multiple hypotheses of the voting model that grounded the experiment. The most basic hypothesis that profit is taken into account while voting was not refuted, as deviations from optimal quantities led to expected profit gains from pro-voting that explain the deviations of acceptance effects from predictions based in RVH, as shown in the previous subsection. Thus refutation of RHV does not mean that participants were not affected in their behavior by earmarking, which was not the case as results for the 50% treatment shown. It means that participants were affected in ways that deviate from RHV predictions. The main implication for policy is that it is harder than suggested by RVH to incentivize individuals to opt for the tax by using earmarking. Such interpretation implies that the priority goal of research should be discovering the behavioral model behind earmarking-incentivized voting. Once this is done, then, based in the same reasoning detailed in section 2.3 above, it would be possible to calculate the degrees of earmarking that could induce the average respondent to accept the tax without a great sacrifice of externality abatement efficiency. The next step would be of course testing these new calculations in an improved version of the experiment here conducted.

It should be stressed that the agenda proposed is not a call for abandoning economic calculation grounded models, which would be contradictory with results. Indeed, participants’ calculations were, from a rational choice perspective, reasonable albeit inexact. In fact, some previous studies resort to factors not related with economic calculation in order to explain aversion to Pigouvian tax, such as attitudes and perceptions (e.g., aversion to the term “tax” and mistrust in government, Kalbekken et al., 2011a and 2011b, Kalbekken and Aesen, 2010, and more generally worldviews, Cherry et al., 2017). Notwithstanding the importance of such factors in practice, a pro-tax incentive mechanism based in earmarking can only be well designed if grounded in an economic calculation model. One paper that contributes in this sense is Tiezzi and Xiao (2016). The authors explain the strong effect of delaying benefits of Pigouvian tax on tax acceptance, as observed in a lab experiment, with deviations from rational choice, namely the propensities to avoid alternatives that are harder to understand (the complexity effect) and to ignore future costs and benefits of current decisions, which can be introduced in an improved economic model.

6 Conclusion

The article measured the effect of earmarking on the economic performance of the Pigouvian tax with randomized treatments applied to a market experiment. This was a pioneer effort in exploring the degree and not, as in previous studies, the mere presence or absence, of earmarking, and also its effect on efficiency, another aspect ignored by literature whose complexity was demonstrated by the results. Earmarking proved to be effective in increasing acceptance of the Pigouvian tax, but not necessarily overall efficiency or welfare, due to the loss of effectiveness in reducing external damage. While earmarking 50% of revenue proved socially justified, the same was not true for earmarking of 80%. Suboptimizing own quantity in one unit and not expecting others’ to optimize their quantities, in deviation with the behaviour hypothesized, affected earmarking effect but did not eliminated it. Experiencing the tax was found to increase neither increase acceptance nor efficiency, but to generate effects deviating more strongly from the predicted and the desired levels. Importantly, lower acceptance under 80% earmarking was due to respondents' understanding that, at such earmarking level, tax was ineffective to reduce externalities.
The results reached are paralleled by previous studies. Specifically in relation to the effectiveness of earmarking in increasing tax acceptance, the present study mirrors Kallbekken et al. (2011), Saelen and Kallbekken (2011), Gevrek and Uyduranoglu (2015) and Heres et al. (2017). A key implication of the findings is the need for coupled theoretical and experimental research on discovering the behavioral model driving acceptance with earmarked tax revenues and the effective fine-tuning of earmarking as an incentive instrument for greater acceptance. This could confirm the evidence found that a 50% earmarking of tax revenue to a direct and immediate cash transfer would increase tax acceptance and efficiency in magnitudes comparable to the estimates of 81 percent points and 14 experimental points, respectively.

One limitation of this study is the type of earmarking considered. In the experiment, earmarking generates direct and immediate return, which is not necessarily feasible in reality. It is important to check whether earmarking in the form of public goods and services, which is indirect and subjected to time lags, but more realistic, would make earmarking less effective than in the experiment carried out. Although these aspects have been addressed by other studies, this was not done with the aim of measuring the effect of earmarking, so further research is needed. In this regard, the time lag in Tiezzi and Xiao (2016) is related to Pigouvian taxes without earmarking. Saelen and Kallbekken (2011), focussing a specific tax (on fuel) to be endorsed with policy-funding earmarking, did not consider different levels of earmarking and measured only the acceptance, but not the efficiency, effect.

References


KALLBEKKEN, Steffen; AASEN, Marianne. The demand for earmarking: Results from a focus group study. Ecological economics, v. 69, n. 11, p. 2183-2190, 2010.


