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# Labor Supply, Taxation and the Use of the Tax Revenues A Real-Effort Experiment in Canada, France, and Germany

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# Labor Supply, Taxation and the Use of the Tax Revenues A Real-Effort Experiment in Canada, France, and Germany [*]

*Claudia Keser [†], David Masclet [‡], Claude Montmarquette [§]*

**Abstract/Résumé**

Is the labor supply of individuals influenced by their perception of how their income taxes will reflow to them or be wasted in administrative expenditures? We examine this issue experimentally by comparing three different treatments of a real-effort game that vary in the degree of redistribution. At one extreme, the Leviathan scenario, where no tax revenue is redistributed to the taxpayers, is compared to the situation where public expenditures are direct transfer payments. In-between, we investigate a situation where tax revenue is used to finance a public good that provides neither direct nor immediate monetary benefits to the taxpayers. We ran this experiment in three different countries, Canada, France, and Germany, to test whether there may exist any country differences in attitude toward taxation and redistribution. We find that effort is significantly higher in the redistribution treatment than the Leviathan treatment. Tax revenue is the highest in the redistribution treatment, followed by the global public good and the Leviathan treatment. On average, the effort is higher in France than in Canada and Germany.

**Keywords/Mots-clés:** Real-Effort Experiment, Taxation, Redistribution, Labor Supply, Laffer Curve

**JEL Codes/Codes JEL:** D31, H23, H53

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## 1. Introduction

In a society, workers are requested to contribute to the financing of governmental expenditures by paying taxes on their labor revenues. Since net wages decrease in tax rates, taxes may have strong disincentive effects by discouraging individuals from earning income, which would cause lower labor supply. Consequently, there should exist an optimal tax rate, above which tax revenues would decrease. This proposition, also known as the "Laffer curve," had considerable influence on fiscal doctrine and supported the "supply-side-economics" argument that a tax cut could increase tax revenues if the government is operating on the *right* side of the curve. The Laffer-curve argument is based on a simple consideration: tax revenues are zero if the tax rate is zero, and are also zero if the tax rate is equal to one when rational agents would withdraw from the market to evade tax and consume untaxed leisure. Therefore, there should exist an optimal tax rate below 100% that maximizes tax revenues.

Previous empirical studies have attempted to estimate the effects of taxes on labor supply, showing that a decrease in tax rates would generate important increases in labor supply (e.g., Hausman, 1981; Ashworth and Ulph, 1981). Natural experiments have been used to assess the impact of a tax-policy change on taxable income (e.g., Lindsey, 1987; Feldstein, 1995; Goldsbee, 1999; Sillamaa and Veal, 2000; Gruber and Saez, 2002).[1] However, it is not possible to confirm, using a natural experiment, the existence of a Laffer curve and the existence of an optimal tax rate: it would be impossible to isolate the pure effect of taxation from various other factors.

To circumvent these difficulties, several authors have resorted to laboratory experimentation with real-effort games in order to study the effect of taxation on labor supply and the potential existence of a behavioral Laffer curve (Swenson, 1988; Sillamaa,1999a; Sutter and Weck-Hannemann, 2003; Ottone and Ponzano, 2007, 2011; Ortona et al., 2008; Lévy-Garboua et al., 2009).[2] In Swenson's experiment, participants are confronted with tax rates chosen by the computer and asked to perform real tasks. Swenson finds a negative substitution effect: beyond a certain level of the tax rate, work effort decreases as the tax rate

[1]For example, the marginal tax rate on the highest-income individuals fell abruptly from 50% to 28% in the US after the 1986 Tax Reform Act.

[2]In real-effort experiments, participants are typically given the choice between an incentivized work task (e.g., decoding numbers into figures or folding letters and putting them into envelops) and an unpaid leisure task (e.g., leisure on the job such as reading newspapers or out of the job, when participants are allowed to leave the experiment earlier).

increases. Sillamaa (1999a, 1999b) replicates Swenson's results in an environment, where another player (who will receive the tax revenue) determines the tax rate. In the same vein, Ottone and Ponzano, (2007, 2011) observe that labor supply significantly decreases when the tax rate grows from 50% to 70%. Sutter and Weck-Hannemann (2003) examine the behavior of a tax authority whose power to tax might be limited by the veil of ignorance at the constitutional level. Investigating the effect of endogenous change of the tax rate on labor supply, they provide evidence of a Laffer curve with tax revenues peaking at tax rates between 50% and 65%. Lévy-Garboua et al. (2009) find that tax revenues decline with increases in the tax rate beyond some level, when the tax rate is chosen by a participant, but not when it is randomly determined by the computer.[3]

In our study, we attempt to contribute to the existing literature by investigating the effect of taxation on labor supply in two specific dimensions, institution, and country. The institution dimension is the way tax revenue collected is used. Efficient institutions may induce less tax avoidance because citizens feel that they are receiving something (i.e., high-quality public services) in return for their money (Frey and Feld, 2002; Frey and Torgler, 2007; Torgler and Schneider, 2007; Cummings et al., 2009).

In contrast, citizens may be more likely to avoid taxes, when they perceive that a non-negligible part of the collected revenue is burnt. In our experiment, we attempt to test this in a stylized way by comparing three different treatments of a real-effort game that differ in the institution. In our baseline, called the *Leviathan* treatment, no tax revenue is redistributed to the taxpayers (Brennan and Buchanan, 1980). Tax revenues may be perceived by the taxpayers as "wasted" or "burnt" in the sense that they do not finance public goods or services (and thus do not generate positive externalities) through the government budget. In a second treatment, called the *redistribution* treatment, a large proportion of the tax revenue is equally redistributed through direct monetary transfers.[4] The remaining proportion of tax revenue that is not redistributed may be considered as administrative expenditures. Finally, in our third treatment, called the *public-good* treatment, a large proportion of the tax revenue is used to finance a public good that provides neither direct nor immediate and monetary

[3]While all the studies mentioned above conclude that taxation may have a negative effect on labor supply, Ortona et al. (2008) find a slight increase in the labor supply, when the revenue of taxation is not left unaccounted but employed to finance public goods and provide insurance against risk.

[4]We assume that each taxpayer receives the same transfer. One might relax this assumption by considering that transfers are targeted toward the poorer people. This might constitute an interesting extension of our study. Note that the introduction of redistribution might be seen as a kind of tax framing. Gamage et al. (2010) report that in their experiment on labor supply the framing of taxes (tax versus wage subsidy) significantly mattered.

benefits to the taxpayers. Concretely, in the public-good treatment, taxes are donated to Greenpeace as a proxy of a global environmental public good. We chose this environmental group because of its high popularity in several countries.

We conjecture that individuals may be more likely to accept taxation when tax revenue is not entirely burnt but is either directly transferred in cash payments or used to finance a public good. Previous studies have shown that the efficiency of the state (i.e., the return in term of public expenditures from tax collection) may be an important determinant of tax compliance (e.g., Wenzel, 2002; Alm and Torgler, 2006). In our experiment, the individuals' willingness to pay taxes may be relatively low (high) if taxpayers perceive that their share in redistribution is small (high).

The second dimension of our study is the country dimension. The extent to which citizens respond to taxation does not only vary across individuals but also across countries (Schneider and Enste, 2013). Countries may not only differ in their institutions but also show important cultural differences that may affect individuals in their reactions to taxation. In our experiment, we report data from a tax laboratory experiment conducted in Canada, France, and Germany. We chose these three countries because several (empirical) studies not only show that they differ in trust but also argue that trust in institutions is important for the success of government policies (e.g., Fukuyama, 1995; LaPorta et al., 1997). According to the 2012 Edelman Trust Barometer that looks at attitudes toward institutions across 25 countries, the percentage of people who trust in government is 31% in France, 33% in Germany while it amounts to 56% in Canada. The World Value Survey (Wave 5: 2005-2008) also reports that general trust is lower in France (18.95%), followed by Germany (37.90%) and Canada (42.95%). Evidence from laboratory experiments tends to confirm these findings (see Willinger et al., 2003, for a comparison between France and Germany; Johnson and Mislin, 2011, provide a meta-analysis).[5] Assuming that more successful tax policy should lead to higher tax compliance as well as lower tax avoidance, we expect that Canadian participants trust their institutions more and therefore avoid taxation less than participants in Germany and France.

[5]Johnson and Mislin (2011) collected data of 162 replications of the investment game (the ''trust'' game by Berg, Dickhaut, and McCabe,1995). They report that the average level of trust, proxied by the average fraction sent in the trust game, is as low as 0.43 in France, 0.51 in Germany and as high as 0.6 in Canada. Willinger et al., (2003) conducted trust-game experiments in France and Germany and showed that German student participants trust others significantly more than those in France.

Our contribution to the existing literature is twofold. First, we investigate to what extent the labor supply (the shape of the Laffer curve) is sensitive to the perception that individuals have regarding the specific use of tax revenues. In previous studies, tax revenue is either fully redistributed or not redistributed at all to the taxpayers. Notable exceptions are the studies by Ottone and Ponzano (2011) and Ortona et al. (2008). While these two papers compare a "no state" to a "welfare state" scenario, the focus of our study is on the nature of the state ranging from the Leviathan to the welfare state as well as on the nature of redistribution (in the form of direct monetary transfers or the provision of a global public good).

Second, we introduce variability in socio-demographic characteristics by organizing the experiment in Canada, France, and Germany. Our paper thus contributes to the existing literature investigating whether attitudes toward taxes and redistribution differ across countries (Frey, 1997; Alm et al., 1995; Torgler, 2003; Cumming et al., 2009; Alm and Torgler, 2006).[6] Furthermore, we can test the robustness of our treatment effects on the introduction of socio-demographic heterogeneity.

To anticipate our findings, we observe that (i) effort decreases monotonically with rising tax rates; (ii) compared to the Leviathan treatments, effort is significantly higher in the redistribution treatment, followed by the public good treatment; (iii) Laffer curves exist in all three treatments; (iv) on average, effort (and thus tax revenue) is higher in France than in Canada and Germany.

The remainder of our paper is organized as follows. We describe the experimental design and procedures in Section 2. In Section 3, we present the theoretical predictions and discuss our behavioral hypotheses. The results are reported in Section 4. In Section 5, we discuss our main findings and conclude the paper.

## 2. Experimental Design

Our experiment is a real-effort experiment inspired by Sutter and Weck-Hannemann (2003). At the beginning of the experiment, participants decide how much to invest in a real effort.

[6]Using laboratory experiments, Alm et al. (1995) found that participants in the United States exhibited higher tax compliance than subjects in Spain. Alm and Torgler (2006) found similar results. Cumming et al. (2009) observed that country differences in tax compliance might be explained by differences in the attitude toward the government, such as the perceived fairness of the tax administration regarding equity of the fiscal exchange.

Using a strategy method (Selten, 1967), each subject has to decide how much effort, *e*, she or he is willing to invest for each possible tax rate, *t*, ranging from zero to 100% in discrete five-percent steps. The interest in using the strategy method is that it gives us effort data for each participant contingent on all possible tax rates. This yields a precise measure of the elasticity of labor supply concerning taxation.[7] Since the participants can leave the experiment sooner if they decide to work less, they are in a situation of a real trade-off between work and leisure. The participants are informed that each unit of effort corresponds to completing a computerized decoding task. For each tax rate, participants can complete as many tasks (between zero and 540) as they wish.

The decoding task adopted in our study is the same as in Lévy-Garboua et al. (2009) and Charness et al. (2013). The task consists of decoding letters into numbers from a table with letters in one column and corresponding numbers in another column that is displayed on the computer screen (see instructions in Appendix A). This task is boring and was chosen by us to induce sufficient disutility of effort. About twelve letters can be decoded per minute. This information was provided to the participants in the instructions.

Each decoded letter pays 4 cents (Euro or CND noted for simplicity Euro/CND). Maximum effort (i.e., the solution of 540 problems) generates an income of 21.60 Euro/CND before taxes. Participants are informed that they have to pay taxes for each decoded letter, which are automatically deducted from a participant's earning. Table 1 provides the net income per decoded letter associated with each possible tax rate. This table is the basis of the decisions of the participants, indicating their effort (between zero and 540 tasks) for each possible tax rate.

After having made effort decisions for each of the 21 potential tax rates, the computer randomly chooses the tax rate that will be implemented. The participants are then requested to perform their intended effort. To stress the trade-off between work and leisure at home, the participants are told that the time they spend in the lab will depend on the number of tasks chosen individually.

[7]From a theoretical perspective, the strategy method should yield the same decisions as the "hot" procedure that involves only observed actions. However, we acknowledge that the strategy method may potentially lead to different behaviors due to its hypothetical character. Brandts and Charness (2011) provided comparisons of behavior between the two methods and found no difference in the huge majority of the studies. More importantly, in no case, the authors found that a treatment effect observed with the strategy method was not observed with the hot procedure.

**Table 1: Tax rate and income per decoded task**

| Tax rate | Net income per decoded task |
|---|---|
| 0 % | 0.040 |
| 5 % | 0.038 |
| 10 % | 0.036 |
| 15 % | 0.034 |
| 20 % | 0.032 |
| 25 % | 0.030 |
| 30 % | 0.028 |
| 35 % | 0.026 |
| 40 % | 0.024 |
| 45 % | 0.022 |
| 50 % | 0.020 |
| 55 % | 0.018 |
| 60 % | 0.016 |
| 65 % | 0.014 |
| 70 % | 0.012 |
| 75 % | 0.010 |
| 80 % | 0.008 |
| 85 % | 0.006 |
| 90 % | 0.004 |
| 95 % | 0.002 |
| 100 % | 0.000 |

Our experiment consists of three treatments that differ in the use of tax revenue. In our baseline treatment called "*Leviathan*," the participants are not informed about what happens with the taxes they have to pay on their revenue. Their perception is that all tax revenues are wasted. The individual payment in Euro/CND for the completion of the decoding tasks is determined by:

$$(1 - \text{tax rate}) \times 0.04 \times \text{number of decoded letters.}$$

The second treatment called "*Redistribution*" is similar to the baseline with the notable exception that the participants are informed that they will immediately benefit from the taxes collected: they are told that 80% of the tax revenue collected in the experimental session will be equally redistributed to all $n$ participants of the session. The total individual payment in Euro/CND for the completion of the decoding tasks is determined by:

$$(1 - \text{tax rate}) \times 0.04 \times \text{number of decoded letters} +$$

$$0.8 \times (1/n) \times \text{tax rate} \times 0.04 \times \text{sum of decoded letters by all n participants.}$$

In the third treatment, called "*Public good*," the tax revenue collected is used to finance a public good: the participants are informed that 80 percent of the sum of the taxes collected in an experimental session will be donated to Greenpeace, whose mission is to expose global environmental problems and their causes. The participants are informed that they will receive a copy of the receipt by e-mail of the sum transferred to Greenpeace.[8]

The individual payment in Euro/CND for the completion of the decoding tasks is determined by:

$$(1 - \text{tax rate}) \times 0.04 \times \text{number of decoded letters.}$$

The amount in Euro/CND transferred to Greenpeace is determined by:

$$0.8 \times \text{tax rate} \times 0.04 \times \text{sum of decoded letters by all n participants.}$$

We have organized experimental sessions with 16 participants. In Canada (CIRANO, Montreal), France (University of Rennes I) and Germany (University of Göttingen), respectively, we ran three to four sessions for each of the three treatments (Leviathan, Redistribution and Public good). This provides us with a total of 28 sessions and 448 participants. No subject participated in more than one session. Table 2 provides an overview

[8]We acknowledge that our choice of Greenpeace is somewhat arbitrary. Nevertheless, we took several precautions in our experiment. First, we provide the participants with some information regarding the main goals of Greenpeace (see the instructions in Appendix A). Second, we sent as promised to each participant a copy of the receipt by e-mail attesting that we did transfer the collected tax revenue to Greenpeace. Third, we checked whether the perception of Greenpeace might have been different across countries by running a post-experimental questionnaire with 178 participants in the three countries in which we asked them to scale from 0 (bad perception) to 10 (very good perception) how they value Greenpeace. Mann-Whitney two-tailed U tests indicate no significant differences in the perceptions across countries (Canada vs. Germany: $z = -0.158$, $p = 0.874$; France vs Germany: $z = -0.436$, $p = 0.663$; Canada vs France: $z = -0.167$; $p = 0.867$). These findings suggest that differences across countries in the perception of Greenpeace are not likely to explain the differences in effort observed in our experiment. Finally in a questionnaire conducted independently from our experiment, we observed no differences in popularity of Greenpeace across countries.

of the different treatment conditions in the various sessions of the experiment conducted in France, Canada, and Germany.

**Table 2: Experimental treatments**

| **Treatment** | Country | Session no. | # Participants |
|---|---|---|---|
| Leviathan | France | 1 | 16 |
| Leviathan | France | 2 | 16 |
| Leviathan | France | 3 | 16 |
| Public good | France | 4 | 16 |
| Public good | France | 5 | 16 |
| Public good | France | 6 | 16 |
| Redistribution | France | 7 | 16 |
| Redistribution | France | 8 | 16 |
| Redistribution | France | 10 | 16 |
| Leviathan | Canada | 11 | 16 |
| Leviathan | Canada | 12 | 16 |
| Leviathan | Canada | 13 | 16 |
| Public good | Canada | 14 | 16 |
| Public good | Canada | 15 | 16 |
| Public good | Canada | 16 | 16 |
| Redistribution | Canada | 17 | 16 |
| Redistribution | Canada | 18 | 16 |
| Redistribution | Canada | 19 | 16 |
| Leviathan | Germany | 20 | 16 |
| Leviathan | Germany | 21 | 16 |
| Leviathan | Germany | 22 | 16 |
| Public good | Germany | 23 | 16 |
| Public good | Germany | 24 | 16 |
| Public good | Germany | 25 | 16 |
| Redistribution | Germany | 26 | 16 |
| Redistribution | Germany | 27 | 16 |
| Redistribution | Germany | 28 | 16 |
| | | Total | 448 |

Before the experiment, each participant was requested to make choices in a modified dictator game, which is a test for (advantageous) inequity aversion introduced by Blanco et al. (2008). Participants are given a list of 21 pairs of payoff vectors in Euro/CND and have to choose one of the two payoff vectors in all 21 cases. The left payoff vector is always (2, 0), which gives the dictator 2 Euro/CND and the recipient nothing. The right payoff vector contains equal payoffs varying from (0, 0), (1, 1) to (20, 20). Each participant decides as a

dictator the payoff of one of the other participants, but will also receive the payoff resulting from the decision made by a third person. One of the 21 payoff vectors is chosen randomly for actual payment. Inequality aversion corresponds to the number of equal choices out of the 21 pairs of payoff vectors.

Also, each participant had to choose her or his show-up fee as a safe payment of 5 Euro/CND or a lottery with a gain of 2 Euro/CND with p = 0.5 or 10 Euro/CND with p = 0.5. The choice of the safe payment can be used as an indicator of risk aversion. The (conditional) decisions to be made in the experiment do not involve any risk other than which tax rate will be chosen by the computer. This test is to compare the participants in the three countries.

After the experimental session was completed, we asked the participants to fill in a questionnaire, in which we elicited several demographics (age, gender, the field of studies). We also asked for the participants' political orientation (0 = left, 10 = right); their general trust (using a question from the World Value Survey); how important are *family*, *friends*, *leisure*, *politics*, *work,* and *religion* in their life (1 = very important, 4 = unimportant).[9] Finally, we asked participants to what extent they agree with the following statements (fully agree (1) – strongly disagree (5)): *i*) receiving money without working for it is humiliating; *ii*) being professionally active is one's responsibility toward society; *iii*) paying taxes is one's responsibility toward society; *iv*) I am willing to sacrifice income for the reduction of environmental pollution; *v*) I am willing to accept a tax increase for the reduction of environmental pollution; *vi*) the government should reduce environmental pollution, but it should not cost me; *vii*) problems of *global warming*, *loss of biodiversity and deforestation*, *water pollution* are important.

The experiment was computerized using the zTree software (Fischbacher 2007) and conducted in French (France), English (Canada) and in German (Germany). On average, the participants earned 16.75 Euro/CND (S.D:7.38).

## 3. Theoretical predictions and behavioral hypotheses

### 3.1. Standard theoretical predictions

[9]The trust question: "Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people?" Yes, most people can be trusted./No, you can never be too careful in dealing with people.

According to the neoclassical theory of labor supply, income taxes are perceived as a disincentive for individuals: as net wages decrease in tax rates, individuals are less willing to work. This negative substitution effect may be partly offset by a positive income effect: the individual will work more to maintain a minimal amount of income. If the individual has a certain budget line, she or he will work more to satisfy this constraint. Thus, the positive income effect may cause an increase in labor supply. However, empirical evidence shows that the negative substitution effect dominates the positive income effect and thus, taxation is detrimental to work effort (Blundell and Macurdy, 1999; Blundell and Shephard, 2012; Meghir and Phillips, 2008).

When tax revenue is redistributed to taxpayers, according to the neoclassical theory, redistribution is likely to cause workers to work fewer hours. This is due to a negative income effect, i.e., the fact that individuals need to work less to maintain the same amount of income when they receive transfers. However, redistribution may also have an opposite effect by increasing effort since redistribution increases the marginal return from labor supply. According to the traditional economic theory of labor supply, this latter effect should be relatively small since, when the state is composed of millions of inhabitants, the private marginal return from one's increase in labor supply regarding redistribution is rather low. Nevertheless, previous studies have shed light on the fact that one should not underestimate this effect. Empirical studies have shown that the taxpayers' perception of how much they receive from the state regarding transfers, public goods or services is an important determinant of tax compliance (Alm and Torgler, 2006; Wenzel, 2002; Ottone and Ponzano, 2011). Thus, in our paper, we focus our attention on the hypothesis that redistribution may increase the marginal return from labor supply.

Our theoretical predictions are derived from a simple model of taxpayer behavior in the context of a small economy, where workers are assumed to have convex and increasing preferences over consumption and leisure time. Following Koenig and Wagener (2013), we consider a separable utility function since it allows focussing our attention on the role of the perception of the efficiency of the state (i.e., the share of the tax revenue received by taxpayers) by removing income effects induced by redistribution. The model emphasizes how the efficiency of the state, (i.e., the share of the tax revenue received by taxpayers) influences taxpayers' decisions. In our simplified model of taxpayer behavior, each worker chooses her or his working hours. The revenue from labor is taxed by the government. Workers are assumed to be identical, rational, and self-interested. We will present first our

predictions regarding the Leviathan treatment, followed by the redistribution and the public-good treatments, respectively.

### 3.1.1. The Leviathan case

Consider the Leviathan treatment in which all collected taxes are burnt (or are gone in bureaucracy) as our benchmark. Each worker *i* has convex and increasing preferences over her/his consumption, $\varsigma_i$, and leisure time, which can be negatively represented by work effort, $e_i$.[10] We assume that these preferences can be represented by the following additively separable utility function :

$$U(\varsigma_i, e_i) = \varsigma_i - c(e_i) \tag{1}$$

Where $c(e_i)$ with $c'(e_i) > 0$ and $c''(e_i) \geq 0$ represents the net disutility from the effort and the reduction of leisure time. This disutility function is increasing in $e_i$ and convex. Consumption depends on the workers' net wage after taxes, multiplied by hours worked such that $\varsigma_i = we_i(1-t)$, where $w > 0$ is the wage rate and $t$ is the tax rate, $t \in [0, 1]$. Substituting this in (1) we obtain:

$$U(\mathrm{e}_i) = we_i(1-t) - c(e_i) \tag{2}$$

For simplicity, we assume that the cost of effort takes the form $c(e_i) = \frac{e_i^2}{\theta_i}$ (Lazear, 1996) such that:

$$U(\mathrm{e}_i) = we_i(1-t) - \frac{e_i^2}{\theta_i} \tag{3}$$

where $\theta_i > 0$ is an individual parameter of disutility of effort. The optimal effort requires that each worker *i* maximizes her/his utility as given by equation (3) with respect to $e_i$. For an interior optimum, the following first-order condition defines the optimal work effort of worker *i* :

[10] We do not distinguish here between work hours and work effort.

$$w(1-t)-\frac{2e_i}{\theta_i}=0 \tag{4}$$

We can solve this first-order condition to obtain the optimal labor supply, $e_i^l$, such that

$$e^l{}_i=\frac{\theta_i w}{2}(1-t) \tag{5}$$

with

$$\frac{\partial e_i^l}{\partial w}=\frac{\theta_i(1-t)}{2}>0; \qquad \frac{\partial e_i^l}{\partial t}=\frac{-\theta_i w}{2}(1-t)<0$$
$$\frac{\partial e_i^l}{\partial \theta_i}=\frac{w}{2}(1-t)>0$$

The following proposition applies:

**Proposition 1.** *Effort decreases with increasing tax rates.*

### 3.1.2. The redistribution treatment

Consider the case, where the tax revenue collected is partly redistributed through direct monetary transfers such that each taxpayer receives an equal transfer. The utility function is now given by:

$$U(\mathrm{e}_i)=we_i(1-t)-\frac{e_i{}^2}{\theta_i}+\frac{\alpha R}{n} \tag{6}$$

with $R=t\sum_{i=1}^{n}we_i$

Where $R$ is the tax revenue, $n$ is the size of the society and $\alpha$, with $\alpha\in[0,1]$, is the share of the tax revenue that is redistributed to each worker.[11] For each worker *i*, maximization of the utility function (6) with respect to $e_i$ yields a best-response function, which is independent of the effort by the other workers. In equilibrium, each worker thus has the dominant strategy to choose $e_i^r$,

[11]The tax revenue that is not redistributed, (1-$\alpha$ ), may be interpreted as administrative expenditures.

$$e_i^r = \frac{\theta_i w}{2}(1-t) + \left(\frac{\theta_i \alpha w}{2n} t\right) \tag{7}$$

with

$$\frac{\partial e_i^r}{\partial w} = \frac{\theta_i}{2}(1-t) + \left(\frac{\theta_i \alpha}{2n} t\right) > 0; \qquad \frac{\partial e_i^r}{\partial \alpha} = \left(\frac{\theta_i w}{2n} t\right) > 0;$$

$$\frac{\partial e_i^r}{\partial t} = \frac{-\theta_i w}{2} + \left(\frac{\theta_i \alpha w}{2n}\right) < 0; \qquad \frac{\partial e_i^r}{\partial n} = \left(\frac{-\theta_i \alpha w}{2n^2} t\right) < 0; \qquad \frac{\partial e_i^r}{\partial \theta_i} = \frac{w}{2}(1-t) + \left(\frac{w\alpha}{2n} t\right) > 0,$$

The comparison of the individually optimal/equilibrium effort in equations (5) and (7) indicates that effort is higher in the redistribution treatment than in the Leviathan treatment. This is stated in Proposition 2:

**Proposition 2.** *Effort is higher in the redistribution treatment than in the Leviathan treatment.*

### 3.1.3. The public-good treatment

Consider the case where the tax revenue collected is used to fund a public good. The utility function is now given by:

$$U(e_i) = we_i(1-t) - \frac{e_i^2}{\theta_i} + \beta_{ij}\alpha R$$
$$\text{with } R = tw\left(e_i + \sum_{j=1}^{n-1} e_j\right) \tag{8}$$

The utility derived from the provided public good financed by the $\alpha$ share of the tax revenue R depends on the parameter $\beta_{ij}$, with $0 \le \beta_{ij} \le 1$, that corresponds to how each *i* (belonging to a society or country *j*) values the public good financed with the taxes (Alm et al., 1993). The higher an individual values the public good, the higher is this parameter $\beta_{ij}$. One may reasonably argue that several individual characteristics, as well as the cultural context, may influence how individuals value the public good.[12]

[12]Previous studies have shown that tax compliance as well as how individuals value state expenditures or the provision of a public good is influenced by gender, age or marital status (e.g., Clotfelter, 1983, Alm et al., 1993). Regarding country differences, past studies have shown that the institutional environment matters (i.e., the complexity of the tas system or whether the government communicates or not on how tax revenue is

In equilibrium, each worker *i* maximizes utility function (8) with respect to $e_i$. The first-order condition yields, for each worker *i*, the best response function, which is independent of the effort of the other workers. In equilibrium, each worker has the dominant strategy to choose:

$$e_i^{r,pg} = \frac{\theta_i w}{2}(1-t) + \left(\frac{\theta_i \alpha \beta_{ij} w}{2} t\right) \tag{9}$$

with

$$\frac{\partial e_i^{pg}}{\partial w} = \frac{\theta_i}{2}(1-t) + \left(\frac{\theta_i \alpha \beta_{ij} t}{2}\right) > 0; \qquad \frac{\partial e_i^{pg}}{\partial \alpha} = \left(\frac{\theta_i \beta_{ij} wt}{2}\right) > 0$$

$$\frac{\partial e_i^{pg}}{\partial t} = \frac{-\theta_i w}{2} + \left(\frac{\theta_i \alpha \beta_{ij} w}{2}\right) < 0; \qquad \frac{\partial e_i^{pg}}{\partial \beta_{ij}} = \left(\frac{\theta_i \alpha wt}{2}\right) > 0; \qquad \frac{\partial e_i^{pg}}{\partial \theta_i} = \frac{w}{2}(1-t) + \left(\frac{\alpha \beta_{ij} wt}{2}\right) > 0$$

It can be easily seen that the individually optimal/equilibrium effort is higher in the public-good than in the Leviathan treatment. Regarding the comparison between the public-good and the redistribution treatment, it will depend on how individuals value the public good. For very low values of $\beta_{ij}$, such that $\beta_{ij} < 1/n$, individuals will exert lower effort in the public-good than in the redistribution treatment. Individuals are indifferent between monetary redistribution and benefitting from the public good if $\beta_{ij} = 1/n$ and thus exert the same effort in both treatments. For relatively high values of $\beta_{ij}$, such that $\beta_{ij} > 1/n$, individuals value more the public good than redistribution such that their effort is higher in the public-good treatment than in the redistribution treatment. This is stated in Proposition 3:

**Proposition 3.** *a) Effort is higher in the public-good than in the Leviathan treatment. b) Effort is lower in the public-good than in the redistribution treatment if* $\beta_{ij} < 1/n$. *It is higher when* $\beta_{ij} > 1/n$.

### 3.1.4. Parameterization of the model

spent). Also, the degree of trust in a country toward institutions may be an important determinant of tax compliance (e.g., Buchanan and Wagner, 1977).

In our model $\theta_i$ is an individual parameter of the disutility of effort. We can approximate an average value of $\theta_i$ using data of observed effort in the absence of taxation: on average, individuals performed 450 tasks. Setting the wage rate at w = 0.04 Euro/CND per task, we can then identify $\theta$ as equal to 22500.[13] Thus, in this Leviathan case, the optimal effort is $e^l = 450(1-t)$. For instance, when the tax rate is 50%, the effort is 225. In the redistribution treatment with $\alpha = 0.8$ and n = 16, the optimal effort is given by $e^r = 450 - 427.5t$. With t = 50%, the effort is 236.25.

Finally, consider the case of the public-good treatment in which tax revenue is used to fund an environmental public good. In this treatment, $\beta_{ij}$ may take a different value depending on how people value the public good. For illustration, if $\beta = 1/n$, then the optimal effort is similar to the one in the redistribution treatment. For t = 50%, the effort is 236.25.

### 3.2. Behavioral predictions

In the model above we have assumed that all individuals are "tax neutral," in the sense that they are neither pathologically averse to taxation nor express an excessive willingness to pay taxes (e.g., Frey, 1997; Fochmann and Weimann, 2011). Indeed, previous studies have shown that, for some tax rate *t*, some individuals are intrinsically motivated to pay taxes (which is sometimes termed as "tax morale") while others are pathological tax avoiders (Frey, 1997; Fochmann and Weimann, 2011). In particular, this may be the case if the tax level is so high that it is perceived as unfair by some taxpayers and thus triggers negative emotions (see Lévy-Garboua et al., 2009). In other words, a fraction of taxpayers may have a strong negative emotional response to an increase of taxation above a certain threshold that may be considered as a fairness norm violation. Lévy-Garboua et al. (2009) have shown that the threshold is 50%, typically. This leads us to the conjecture H1.

**H1.** *a) The relationship between effort and taxation is not necessarily linear. b) Participants may react by tax avoidance to high levels of taxation (likely above 50%) if it is considered as unfair.*

[13] This is the solution for $\theta$ of $\frac{0.04\theta}{2} = 450$.

Our second behavioral hypothesis concerns the fact that there may exist both individual and country heterogeneity in response to taxation as well as in the perception of how tax revenue is used. Several previous studies have shed light on both the importance of individual heterogeneity (e.g., Clotfelter, 1983) and country heterogeneity (e.g., Frey, 1997; Alm et al., 1995; Torgler, 2003; Cummings et al. 2009; Alm and Torgler, 2006). Some authors have shown that tax morale is related to demographics, such as age, gender, or marital status, as well as social preferences (Clotfelter, 1983). For instance, Clotfelter (1983) indicates that tax evasion is negatively related to age, and may depend positively on being married. Other studies have shown that attitudes toward taxation differ across countries (e.g., Frey, 1997; Alm et al., 1995; Torgler, 2003; Cumming et al., 2009; Alm and Torgler, 2006).[14] It is often argued that the differences in tax compliance observed across countries could be explained by differences in the attitude of the population toward their respective governments regarding the fairness of the tax administration and the perceived equity of the fiscal exchange. Following Hessing et al., (1992), and Skinner and Slemrod (1985), we can take into account this heterogeneity by replacing the tax rate $t$ in the model presented above by the perceived tax burden $\tau_{ij}(t)$. One may consider that individuals are "tax-averse" if they are reluctant to pay taxes because they tend to over-estimate the cost of taxation such that $\tau_{ij}(t) > t$. Consequently, tax-averse individuals react more than proportionally to an increase in the tax rate. To the opposite, individuals are "tax-moral" agents if they underestimate the cost of taxation and therefore respond less than proportionally to an increase in the tax rate such that $\tau_{ij}(t) < t$.[15] Finally, we refer to "tax-neutral" agents for individuals who respond proportionally to an increase in the tax rate such that $\tau_{ij}(t) = t$. Taking the heterogeneity in the perceived tax burden into account, we can rewrite Eq. (3) as follows:

$$U(\mathrm{e}_i) = we_i\left(1-\tau_{ij}(t)\right) - \frac{e_i^{\,2}}{\theta_i} \tag{10}$$

[14]In a laboratory experiment, Alm et al., (1995) compared Spain and the United States and found that participants in the United States exhibited higher tax compliance than subjects in Spain. Alm and Torgler (2006) found similar results using information from the World Value Survey. According to the authors, it is in the United States that we observe the highest tax morale among the taxpayers, followed by Australia and Switzerland. Cumming et al. (2009) combined both experimental and survey data from the United States, Botswana, and South Africa.

[15]One may reasonably argue that some individuals may be willing to pay even more taxes than the imposed taxes. Such "taste" for taxation may reflect in voluntary funding of charities.

We may thus reasonably argue that there may exist some important heterogeneity in reactions to taxation and redistribution across both individuals and countries. This is stated in H2.

**H2.** *a) Reactions to taxation and redistribution differ across individuals. b) Reactions to taxation and redistribution differ across countries.*

Our third conjecture concerns heterogeneity across individuals and countries regarding how they value the environmental public good (which is reflected in our model by the parameter $\beta_{ij}$). Based on survey data, Alm et al. (1992) suggested that individuals may be willing to pay taxes because they value the goods provided by the government. In our study, we focus our attention on how the reaction to taxation differs across individuals as well as across countries when taxes are used for the funding of an environmental public good.

The OECD provides valuable information regarding how people value the environment in each of the three countries under consideration. For this purpose, the OECD uses a better-life index based on two measures with respect to the environment, water quality, and air pollution.[16] According to this index, with a scale from zero (very low environmental concerns) to ten (very deep environmental concerns), Canada is ranked first with an index of (8.2) followed by Germany (7.8) and France (7.1).[17] Note also that according to Eurostat, the share of environmental tax revenues over total tax revenues (mean values) is higher in Germany (6.1%) than in France (4.9%), (see Cadoret et al., 2017).

We cautiously argue that individuals (or countries) with greater concerns for the environment may be more likely to exert effort in the global public good treatment. This leads to our conjecture H3.

[16]Concerning water quality, OECD calculations are based on data from Gallup World Poll (reference year 2012). The indicator captures people's subjective appreciation of the environment where they live, in particular, the quality of the water. It is based on the question: "In the city or area where you live, are you satisfied or dissatisfied with the quality of water?" The indicator considers people who responded they are satisfied. The measure of air pollution is based on data from the Global Burden of Disease assessment (reference year 2013). The indicator is the population weighted average of annual concentrations of particulate matters less than 2.5 microns in diameter in the air.

[17] See http://www.oecdbetterlifeindex.org/topics/environment.

**H3.** *a) Individuals with* stronger environmental concerns may be less likely to avoid taxes. *b) Among the experiment participants, Canadians may express greater environmental concerns than Germans, and those may express higher environmental concerns than French, which should translate into the respectively higher effort in the environmental public-good treatment.*

## 4. Results

### 4.1. Effort in each treatment

Figure 1 shows the average effort conditional on the tax rate in each of the three treatments. Consistent with our Proposition 1, we observe that in all treatments, effort decreases with rising tax rates. These findings are also consistent with previous findings (Sutter and Weck-Hannemann, 2003). We also observe that the relationship between tax rate *t* and effort is non-linear. It is represented by a concave function, suggesting that on average individuals are "tax-moral" agents, in the sense that they tend to react less than proportionally to an increase in the tax rate. This is consistent with our behavioral assumption H1a. We also observe a break at the 50% tax rate. Participants seem to consider as unfair all tax rates above 50% and therefore, may react by sharply reducing their labor supply (e.g., Lévy-Garboua et al., 2009). This supports our hypothesis H1b.[18]

However, these average figures hide some important heterogeneities across individuals. Consistent with our conjecture H2a, we observe important differences in reaction to taxation across participants as shown in Figures B1 and B2 in Appendix B. Figure B2 shows that while for a large majority of participants, their effort decreases monotonically as the tax rate increases (type C: 61%, 55% and 59% of individuals in the Leviathan, the redistribution, and the public-good treatment respectively), a non-negligible number of participants exert first the highest effort possible to sharply decrease their effort to zero effort after the 50% tax rate (type A: 19%, 10% and 12% respectively in the Leviathan, the redistribution and the public-good treatment ). A minority of participants chose to perform the highest effort for all tax rates, even at a 100% tax rate (type D), or for almost all tax rates (type B), while another minority exert zero effort unconditionally to the tax rate (type F).[19]

[18]Contrary to Lévy-Garboua et al., (2009), this situation occurs despite the fact that the tax rate is randomly chosen by the computer.

[19]We observe that participants are, on average, not willing to offer maximum effort in order to earn maximum income at the 0% tax rate: the average effort is 430.21 in the Leviathan, 435.76 in the

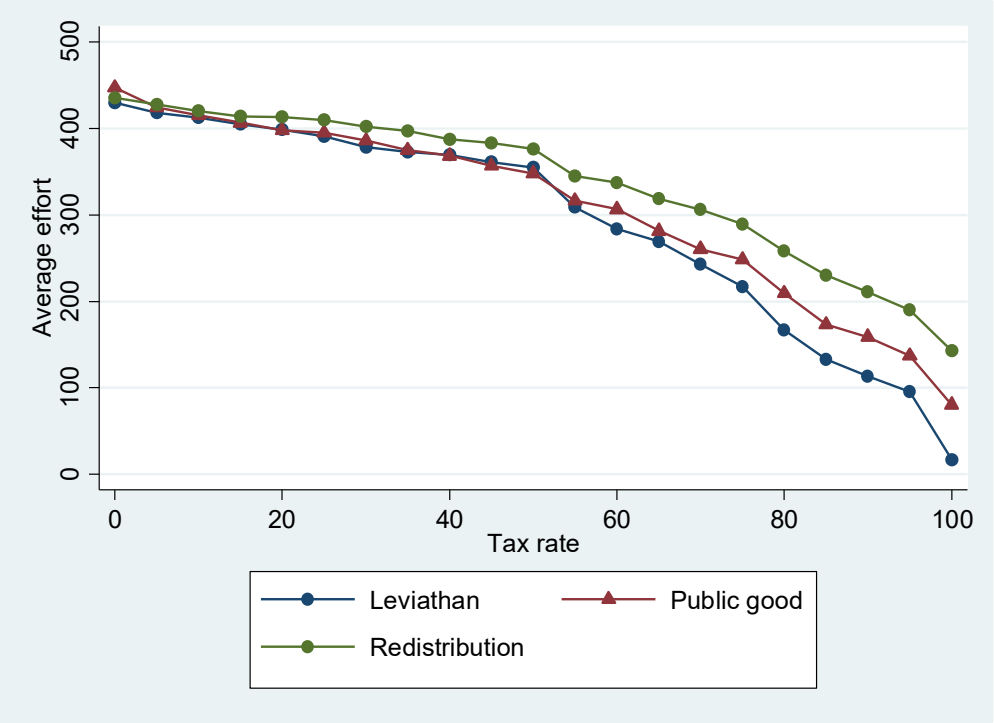
Let us now consider differences in effort between treatments. Consistent with our Propositions 2 and 3, the average effort, considering all tax rates, is highest in the redistribution treatment (337.88, S.D.206.84) and lowest in the Leviathan treatment (292.37; S.D.221.874).[20] A Wilcoxon-Mann-Whitney test indicates that the difference between the Leviathan and the redistribution treatment is statistically significant (p=0.0045; two-sided). The average effort is also higher in the public-good treatment (309.20, SD 224.98) than in the Leviathan treatment, but this difference is not statistically significant (p = 0.2404). The difference is, however, significant for the tax rates above 70% (p = 0.0408). Figure 1 also indicates that the average effort declines less rapidly and less steadily in the redistribution and the public-good than in the Leviathan treatment.

A majority of participants choose zero effort at a 100 % tax rate in the Leviathan treatment (117 out of 144 subjects). This figure amounts to 77 subjects out of 144 in the public-good treatment, and 62 subjects out of 160 in the redistribution treatment. Participants in the Leviathan treatment exerting positive effort at the 100% tax rate is unexpected, considering that there is no return associated with the tax revenue.

redistribution, and 447.53 in the public-good treatment). This finding suggests that subjects perceive the requirement to decode as a sufficiently boring task with an opportunity cost in terms of leisure. Note that only few participants fall into the sixth category presented in Figure B2, which appears less consistent than the others (type E: 3%, 6% and 7% in the Leviathan, public-good and the redistribution treatment, respectively).

[20]See also Table 4.

**Figure 1: Effort choices by treatment**




Our key findings are summarized in Result 1.

**Result 1.** *a) In all treatments, effort choices decrease (almost) monotonically with rising tax rates except for a break at a 50% tax rate. b) Compared to the Leviathan treatment, the effort is significantly higher in the redistribution treatment followed by the public-good treatment.*

**Support for Result 1.** Table 3 reports the regression estimates on the determinants of effort. The use of random-effects Tobits is justified by the panel-nature of the data and to account for left- and right-censored observations in the sample. In column (1) of Table 3, we control for tax rates and treatment effects and include country dummies. Column (2) includes two interaction variables "Global treat.*100% tax rate" and "Redist treat.*100%tax rate" variables. Demographics are included in column (3). Column (4) replicates column (3) but only for the tax rates above 50%. Column (5) considers the determinants of effort in the absence of taxes. Finally, column (6) provides some robustness checks by controlling

whether differences in theoretical predictions across our treatment matter. As shown above, observed differences in theoretical predictions were relatively marginal. However, it is important to control it by introducing two additional independent variables: "Redis.*Differences in theoretical predictions" and "Public good*Differences in theoretical predictions."[21]

Table 3 shows that effort decreases with the tax rate, with a sharper decrease in the highest tax rate at 100 %, in particular, for the Leviathan treatment. It also indicates that effort is significantly higher under the redistribution treatment than the Leviathan and the public-good treatment. Results reported in column (4) for the tax rates above 50 % indicate that the variable "Public good" is now significant (at the 10 % level), suggesting a positive effect of the public-good treatment relative to the Leviathan treatment in the context of high tax rates. In the last column of Table 3, the variables that account for differences in the theoretical prediction are not significant and are consistent with our main findings. Altogether, these results indicate that the perception of how the tax revenue is used matters.

[21]Differences in theoretical predictions are built as follows: (theoretical prediction of the public-good treatment (redistribution) - theoretical prediction of the Leviathan)/theoretical prediction of the Leviathan treatment. These variables are included in model (6) that replicates model (2). We also included these two additional variables in the other estimates shown in Table 5. Introducing these variables left unchanged our findings. All estimations are available upon request.

**Table 3: Determinants of effort**

| Variable | All tax rates RETobit (1) | All tax rates RETobit (2) | All tax rates RETobit (3) | Tax rate > 50% RETobit (4) | 0% tax rate Tobit (5) | All tax rates RE Tobit (6) |
|---|---|---|---|---|---|---|
| Tax rate | -5.042*** | -5.036*** | -5.036*** | -8.093*** | | -5.030*** |
| | (0.0727) | (0.0724) | (0.0727) | (0.256) | | (0.0796) |
| 100 % tax rate | -150.4*** | -271.6*** | -271.3*** | -88.30*** | | -151.5*** |
| | (9.918) | (19.68) | (19.68) | (10.95) | | (12.20) |
| Leviathan | Ref. | Ref. | Ref. | Ref. | Ref. | Ref. |
| Redistribution | 100.1*** | 88.52*** | 94.22*** | 163.9*** | 6.186 | 107.0*** |
| | (33.06) | (32.93) | (32.44) | (35.97) | (42.37) | (32.66) |
| Public good | 47.66 | 41.80 | 37.67 | 70.16* | 26.00 | 43.44 |
| | (33.78) | (33.66) | (33.07) | (36.73) | (43.69) | (33.21) |
| Redist*diff. pred. | | | | | | -7.008 |
| | | | | | | (16.10) |
| Publicgood*diff. pred. | | | | | | 4.825 |
| | | | | | | (20.15) |
| Redist*100 % rate | | 197.1*** | 197.6*** | | | |
| | | (24.33) | (24.36) | | | |
| Publicgood*100 % rate | | 126.4*** | 130.0*** | | | |
| | | (25.29) | (25.33) | | | |
| France | Ref. | Ref. | Ref. | Ref. | Ref. | Ref. |
| Germany | -159.7*** | -159.9*** | -123.8*** | -183.9*** | -60.27 | -123.5*** |
| | (33.02) | (32.87) | (38.90) | (43.31) | (49.79) | (39.07) |
| Canada | -95.19*** | -96.07*** | -70.86 | -115.5** | -10.79 | -69.98 |
| | (33.13) | (32.98) | (44.11) | (49.02) | (57.52) | (44.31) |
| Male | | | 44.06 | -8.700 | 102.9*** | 44.40 |
| | | | (27.55) | (30.56) | (36.21) | (27.67) |
| Age | | | -1.406 | 0.944 | -6.256* | -1.359 |
| | | | (2.687) | (2.978) | (3.275) | (2.700) |
| Level of study | | | 3.804 | -0.0597 | -3.443 | 3.652 |
| | | | (12.13) | (13.46) | (15.30) | (12.18) |
| Inequ. aversion | | | 2.055 | 6.103* | -4.656 | 2.126 |
| | | | (3.043) | (3.392) | (3.973) | (3.057) |
| Tax moral | | | 105.2* | 126.1** | 57.06 | 106.0* |
| | | | (54.28) | (60.18) | (70.46) | (54.53) |
| Pollution | | | 21.13 | 32.36 | -22.83 | 21.97 |
| | | | (34.50) | (38.30) | (46.01) | (34.65) |
| Biodiversity | | | -60.67 | -113.6 | 33.18 | -63.40 |
| | | | (77.58) | (85.99) | (96.28) | (77.94) |
| Political direct. | | | -5.308 | -0.480 | -15.31* | -5.481 |
| | | | (6.310) | (6.993) | (8.257) | (6.338) |
| Trust | | | 27.91 | 13.94 | 34.34 | 27.59 |
| | | | (28.92) | (32.08) | (38.01) | (29.05) |
| Risk aversion | | | 67.92** | 60.67* | 101.5*** | 68.34** |
| | | | (28.31) | (31.42) | (36.29) | (28.44) |
| Constant | 674.3*** | 679.5*** | 572.9*** | 749.0*** | 697.7*** | 567.6*** |

| | (30.72) | (30.60) | (118.0) | (132.5) | (148.8) | (118.6) |
|---|---|---|---|---|---|---|
| Observations | 9,408 | 9,408 | 9,366 | 4,014 | 446 | 9,366 |
| Left cens. | 1133 | 1133 | 1131 | 988 | 2 | 1131 |
| Log. likelihood | -35909,57 | -35875.19 | -35710,76 | -15958,8 | -1407,48 | -35745,2 |

Note: Standard errors are in parentheses. ***, **, * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively for the two-tailed test. Dummy variables are included in estimates (2) to (6) for fields as well as a dummy for inconsistent participants in their decisions, (i.e. for instance those who chose a low for a tax rate t, then a higher effort for a tax rate t+1 and again a lower effort for a tax rate t+2). The 9408 observations in columns (1) and (2) correspond to the 448 subjects observed for 21 possible tax rates. The 9366 observations in column (3) that control for demographics correspond to 446 participants (because two participants left the experiment without answering all the questions of the questionnaire.

### 4. 2. Individual and country heterogeneity in effort

Let us consider now the heterogeneity across countries. Before analyzing our data regarding effort, it is instructive to investigate whether there exist any differences across countries in demographics and the answers to the post-experimental questionnaire.[22]

In Table 4, we compare the sample characteristics of the participants in the three countries. French participants are significantly younger (19.58, SD 1.32) than Canadian (27.51, SD: 8.76) and German (24.75 SD: 4.23) participants. Canadian participants are on average older than Germans. All these differences are statistically significant (t-tests). On average, participants from France mistrust others more than the Canadian and German participants: 23.75% of the French participants report that they can trust others, while 44.44% and 46.47% of the participants in Germany and Canada, respectively, do so. While the difference is not statistically significant between Germany and Canada, it is highly significant between France and each of the two other countries. These figures are consistent with those obtained from the World Value Survey.[23,24] Regarding our measure of inequality aversion, French participants are more inequality averse than participants in the two other countries. The differences are highly significant.

[22]Note that one has to be cautious when interpreting these data for several reasons. First, due to the absence of incentives, the responses may be considered, to some extent, as pure "cheap talk". Second, subjects might use the questionnaire to 'justify' their decisions ex post. Nevertheless, despite all these limitations, such data may be particularly useful in digging deeper into the individual motivations behind effort decisions (see Croson, 2005).

[23]Interestingly these figures are very close to those obtained from the data of the World Value Survey (Wave 5: 2005-2008) indicating that the trust level is lower in France (18.95%), followed by Germany (37.9%) and Canada (42.95%).

[24]Willinger et al. (2003) conducted trust-game experiments in France and in Germany and showed that German student participants do trust others significantly more than those in France.

**Table 4: Means (standard deviations) and mean differences in socio-demographics**

| Socio-demographics | France | Germany | Canada | Canada-Germany diff. | France-Germany Diff. | France-Canada Diff. |
|---|---|---|---|---|---|---|
| Gender | 56.25% | 55.55% | 51.41% | -4.14% | 0.70% | 4.84% |
| Age | 19.58 (1.32) | 24.75 (4.23) | 27.51 (8.76) | 2.76*** | -0.5.17*** | -7.93*** |
| Political direction | 4.78 (0.15) | 4.61 (0.18) | 4.59 (0.21) | -0.19 | 0.17 | -0.02 |
| Trust | 23.75% | 44.44% | 46.47% | 2.28 | 20.69*** | -22.72*** |
| Inequality aversion | 4.53 (0.33) | 7.01 (0.37) | 7.38 (0.44) | 0.36 | -2.48*** | -2.85*** |
| Pollution | 77.5% | 79.86% | 82.63% | 2.77% | -2.36% | -5.13% |
| Biodiversity | 96.25% | 95.14% | 97.91% | 2.77% | 1.11% | -1.66% |
| Tax moral | 92.50% | 93.75% | 93.05% | -0.69% | -1.25% | -0.55% |

Note: *** Significant at the 0.01 level ** at the 0.05 level * at the 0.10 level. Political direction corresponds to the answer to the following question "How would you, generally speaking, place your views on a scale from 0 (left) to 10 (right)?" Trust corresponds to the answer 0 = "we cannot trust others"; 1 = "we can trust others." Inequality aversion corresponds to the number of equal choices out of 21 pairs of payoff vectors. Pollution corresponds to the answer to the question: Please indicate to what extent you agree or disagree to the sentence: I would be willing to accept a tax increase if the additionally collected money was used to reduce environmental pollution: 1 = I agree, 0 = I disagree. Biodiversity corresponds to the question: Please indicate to what extent you agree with the importance of the loss of biodiversity and deforestation: 1 = I agree; 0 = I disagree. Tax moral corresponds to the question: It is one's responsibility toward society to pay taxes: 1 = I agree; 0 = I disagree.

Regarding effort choices, Table 5 indicates differences between countries in reaction to taxation, which is consistent with our conjecture H2a. The average effort (for all tax rates and all treatments) is 369.33 (SD 202.08) in France while it amounts to 298.42 (SD 225.13) in Canada and 268.21 (SD 216.08) in Germany. The difference in the average effort is statistically significant between France and Canada ($z = -3.544$; $p = 0.0004$) and between France and Germany ($z = -5.704$; $p = 0.0000$). We find no statistical significance of the difference between Canada and Germany ($z = -1.529$; $p = 0.1264$). Overall, this partially supports our conjecture H2b.

**Table 5: Summary statistics on effort and tax revenues**

| **Treatment** | Country | Effort | Tax revenue |
|---|---|---|---|
| Leviathan | France | 350.71 (205.61) | 91.23 (83.81) |
| Leviathan | Canada | 268.81 (226.85) | 64.56 (73.66) |
| Leviathan | Germany | 257.59 (220.95) | 57.81 (65.50) |
| *Leviathan* | *All* | *292.37 (221.83)* | *71.20 (76.06)* |
| Public good | France | 371.23 (213.80) | 97.91 (89.20) |
| Public good | Canada | 299.14 (225.46) | 77.85 (82.95) |
| Public good | Germany | 257.24 (220.81) | 62.73 (75.56) |
| *Public good* | *All* | *309.20 (224.98)* | *79.49 (83.98)* |
| Redistribution | France | 381.87 (189.05) | 106.03 (86.91) |
| Redistribution | Canada | 327.33 (219.41) | 89.40 (89.34) |
| Redistribution. | Germany | 289.79 (204.67) | 77.16 (75.15) |
| *Redistribution.* | *All* | *337.88 (206.84)* | *92.38 (85.16)* |

**Figure 2: Average effort choices over the three treatments by the tax rate and by country**

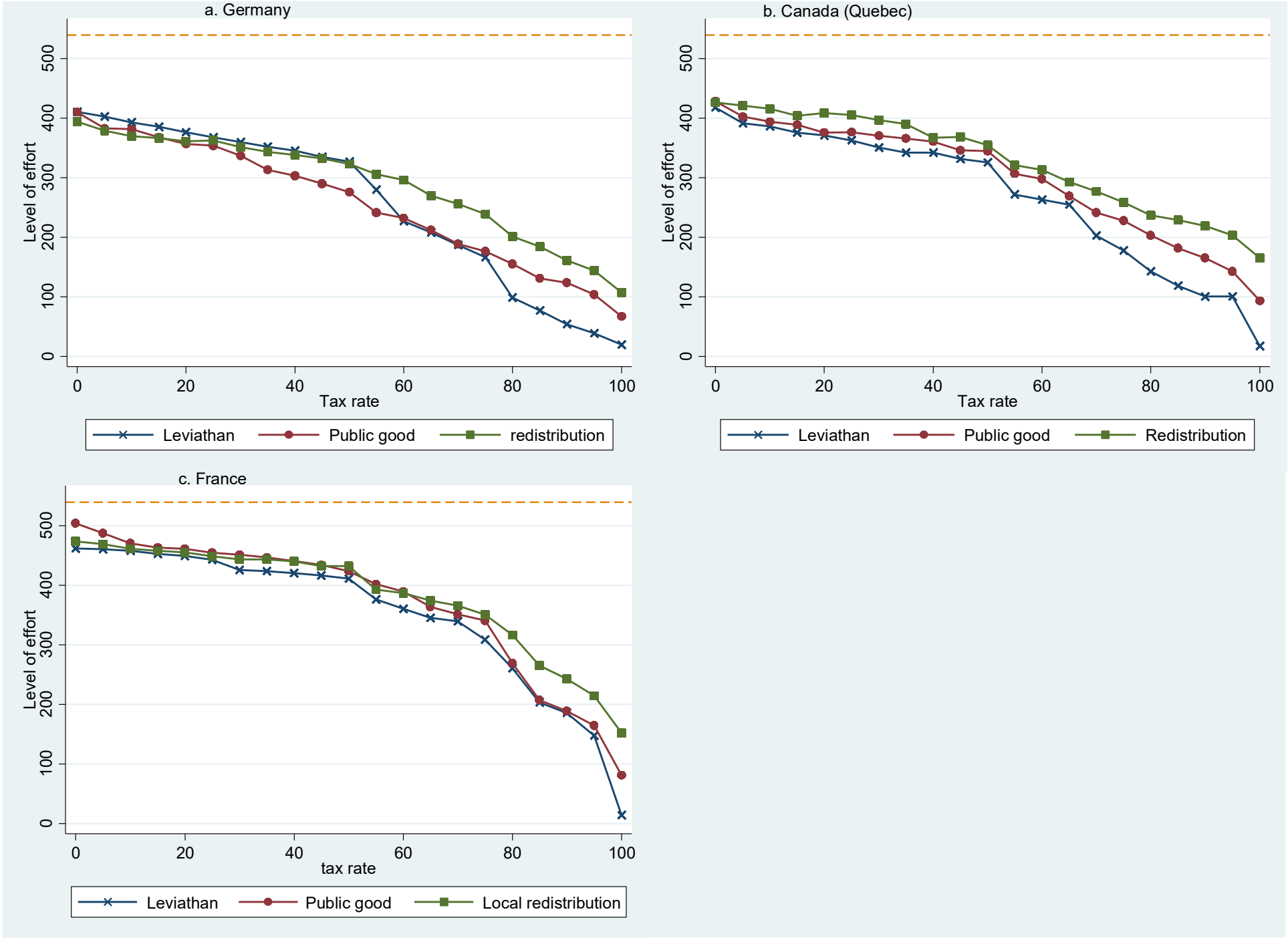


Figure 2 (a-c) displays the average effort levels over the three treatments by the tax rate and by country.[25] While for tax rates between 5% and 50%, the slope of the effort-supply functions is similar in all three countries; the slopes differ for tax rates above 50%. In particular, the slope remains much flatter up to a tax rate of 75% in France than in Canada and Germany. These findings may potentially reveal some country differences in tax salience: consistent with our proposition; some countries may underestimate the burden of taxation while others may overestimate it. Our findings are summarized in Result 2.

**Result 2.** *a) The average effort is higher in France than in Canada and Germany. b) The slope of the effort-supply functions differs across countries for tax rates above 50%, being much flatter up to a tax rate of 75% in France than in Canada and Germany.*

**Support for Result 2.** The demographic variables included in the column (3) of Table 3 are not significant except for the variable "risk aversion" and ¨tax moral¨ (one's responsibility toward society to pay taxes), both variables increasing the level of effort. The variable "tax morale" posting a positive and significant coefficient is consistent with the previously existing literature showing (Alm and Torgler, 2006). The variable "risk aversion" with a positive and significant coefficient, suggests that the more risk-averse individuals are more likely to exert effort. Male significantly show a higher effort level than female at the 0% tax rate. The variables associated with environmental concerns are not statistically significant, which refutes our conjecture H3a. Note that also H3b is refuted due to the differences in "pollution" as well as "biodiversity" not being significant between countries (Table 4).

Columns (1) and (2) of Table 3 show that the effort level is significantly lower in Germany and Canada, relatively to France. The coefficient on the dummy variable "Canada" is no more significant after controlling for demographics.

Results reported in column (4) indicate that Canada and Germany show significantly lower effort for the tax rates above 50%. In column (5) of Table 3, regressing the effort level in the absence of taxes, none of the treatments nor country's coefficient estimates are significant.

[25]Figures 1 and 2 and Table 4 show that the average effort level is the highest in the redistribution and the lowest in the Leviathan treatment. However, in neither country does the Kruskal-Wallis test indicate that the treatment differences are statistically significant (requiring $p \leq 0.10$). When we consider tax rates above 50%, we do observe a statistically significant difference among the three treatments in Germany ($p = 0.0407$). In Canada, the Kruskal-Wallis test just fails significance ($p = 0.1063$). In Germany, the effort for tax rates above 50 % is significantly higher in the redistribution treatment than in the public-good ($p = 0.0601$) or the Leviathan treatment ($p = 0.0131$, U tests).

Thus, it seems that if more effort is performed by participants in France when the tax rate is positive, this is not because French participants exert more effort per se or have a lower disutility of effort, but that French participants react differently to taxation. Finally, in column (6), we see that adjusting for the difference in theoretical predictions plays no role.

In Table 6, we examine the determinants of participants refusing to work at a given tax level. Using a random-effects probit model, we observe that the probability of refusing to work rises with the tax rate and more so for the highest tax rates. This probability is lower for the redistribution treatment than the public-good and the Leviathan treatment. None of the control variables is significant except for the "male (+)" and the "tax morale (-)" variables.

**Table 6: Determinants of the probability of showing no effort (RE probit)**

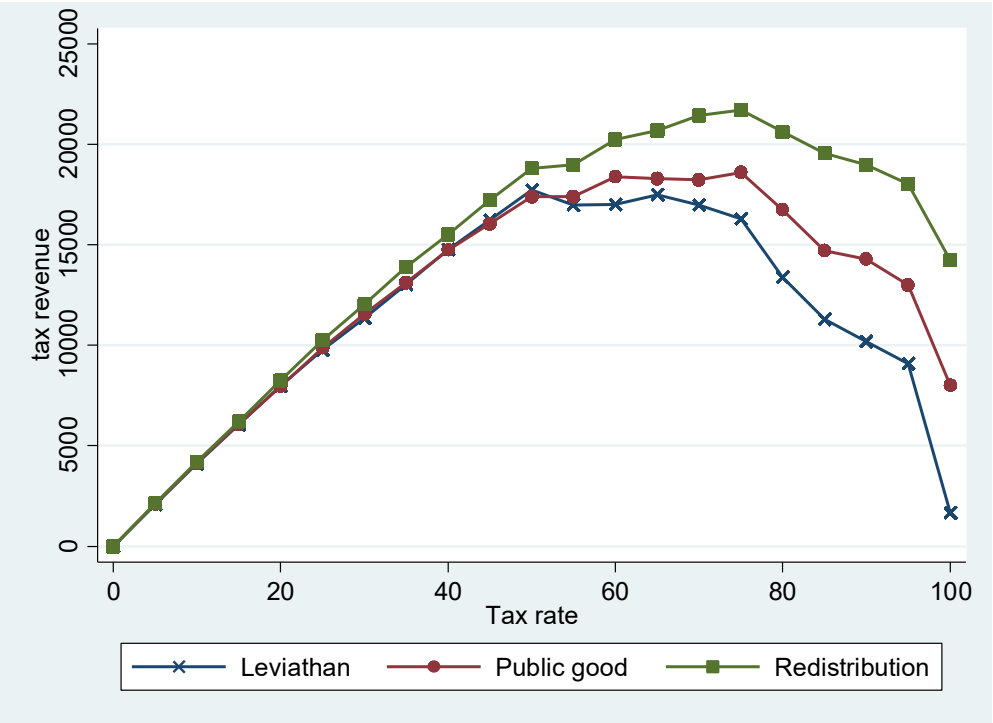
| Variable | (1) | (2) |
|---|---|---|
| Tax rate | 0.094*** | 0.094*** |
| | (0.004) | (0.004) |
| 100% tax rate | 3.087*** | 3.128*** |
| | (0.394) | (0.395) |
| Leviathan | Ref. | Ref. |
| Local public good | -2.768*** | -2.545*** |
| | (0.528) | (0.522) |
| Public good | -0.647 | -0.700 |
| | (0.475) | (0.468) |
| Redist*100% rate | -1.252** | -1.312*** |
| | (0.498) | (0.497) |
| Public good*100% rate | -1.929*** | -2.005*** |
| | (0.464) | (0.465) |
| France | Ref. | Ref. |
| Germany | 0.147 | 0.865 |
| | (0.459) | (0.545) |
| Canada | -0.0472 | 0.577 |
| | (0.460) | (0.615) |
| Male | | 0.996*** |
| | | (0.386) |
| Age | | -0.035 |
| | | (0.039) |
| Level of study | | -0.144 |
| | | (0.169) |
| Inequ.aversion | | -0.058 |
| | | (0.042) |
| Trust | | 0.376 |
| | | (0.401) |
| Political direct. | | 0.094 |
| | | (0.087) |
| Tax moral | | -1.377* |
| | | (0.742) |
| Pollution | | -0.289 |
| | | (0.476) |
| Diversity | | 0.454 |
| | | (1.072) |
| Risk aversion | | -0.488 |
| | | (0.394) |
| Inconsistent | *no* | *yes* |
| Field of study | *no* | *yes* |
| Constant | -9.687*** | -8.534*** |
| | (0.558) | (1.639) |
| Observations | 9408 | 9366 |
| Log likelihood | -1138.37 | -1117.28 |

Note: Standard errors are in parentheses. ***, **, * indicate significance at the 0.01, 0.05, and 0.10 levels, respectively for the 2-tailed test. Dummy variables are included in the estimate (2) for fields of study as well as a dummy for inconsistent participants in their decisions.

### 4.3. Tax revenues

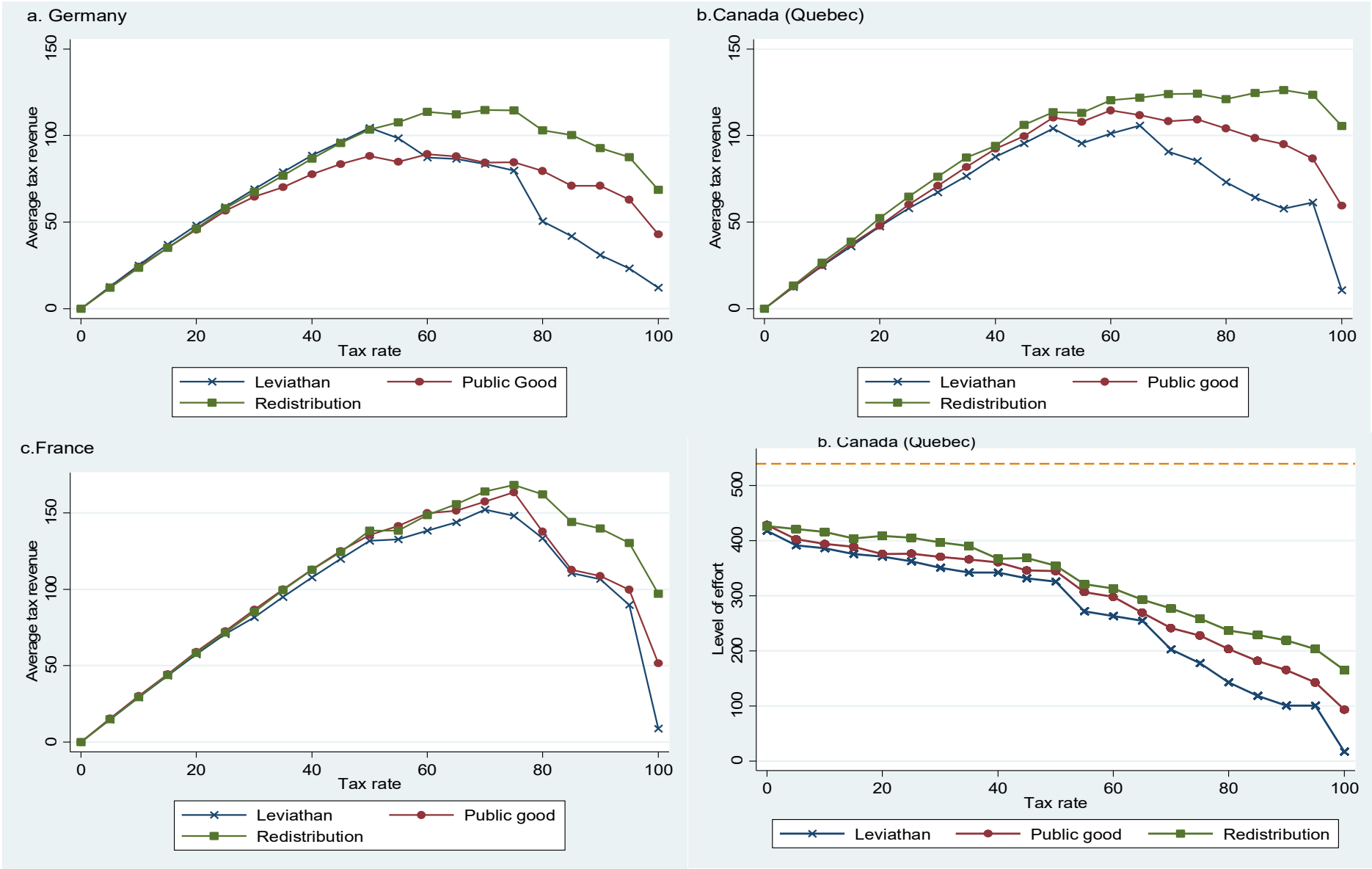
In Figure 3, we present the average tax revenues, conditional on subjects' effort by tax rates from zero to 100. Up to the tax rate of 50%, tax revenues increase linearly in the Leviathan treatment. After the 50% tax rate, tax revenues decrease slowly and then fall strongly after the 70% tax rate. The shape of this Laffer curve on tax revenues arises mainly from two effects: First, higher tax rates reduce the net income from a marginal increase in effort and, thus, drive down the effort and consequently the tax revenues. Second, higher tax rates might be considered to be unfair, giving workers an emotionally driven incentive to 'punish' tax authorities by offering lower effort, therefore reducing tax revenues (see Lévy-Garboua et al., 2009).

**Figure 3: Average tax revenues by treatment**



In the public-good treatment, the maximum of the Laffer-like curve is reached at 70% against 50% in the Leviathan. The tax revenues are the highest for all tax rates in the redistribution treatment. The difference in the average tax revenues is statistically significant between the redistribution and the Leviathan treatment ($p = 0.0005$). Average tax revenue is also higher in the public-good than the Leviathan treatment, but the difference is not statistically significant ($p = 0.2635$). A statistically significant difference between the public-good and the Leviathan treatment is found for tax rates above 70% ($p = 0.0373$).

**Figure 4: Tax revenue by treatment and country**



Regarding country differences, Figure 4 indicates that tax revenues in France are higher than those in Canada and Germany for all level of taxes, except at zero. Average tax revenue (see Table 4) is significantly higher in France than in Canada ($p = 0.0002$) and in Germany ($p = 0.0000$) . Average tax revenue is lower in Germany, relatively to Canada, but the difference is not statistically significant ($p = 0.1529$).

Our key findings are summarized in Result 3.

**Result 3.** *a) Average tax revenue is the highest in the redistribution treatment, followed by the public-good and the Leviathan treatment. b) Tax revenue is higher in France than in Canada and Germany.*

**Support for Result 3.** Tables 7 and 8 support the result 3 for tax revenue.

**Table 7: The determinants of tax revenue: OLS estimates with clustering on individuals**

| Variables | All | Baseline | Redistribution | Public good | Germany | France | Canada |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Tax rate | 4.088*** | 4.352*** | 3.949*** | 3.981*** | 3.481*** | 5.043*** | 3.637*** |
| | (0.129) | (0.235) | (0.200) | (0.238) | (0.226) | (0.209) | (0.214) |
| Tax rate squared | -0.820*** | -0.975*** | -0.697*** | -0.801*** | -0.743*** | -0.987*** | -0.711*** |
| | (0.03) | (0.056) | (0.053) | (0.058) | (0.055) | (0.056) | (0.053) |
| Leviathan | Ref. | | | | Ref. | Ref. | Ref. |
| Redistribution | 19.411*** | | | | 19.35** | 14.802* | 24.842** |
| | (5.506) | | | | (9.224) | (8.639) | (10.940) |
| Public good | 8.298 | | | | 4.924 | 6.682 | 13.289 |
| | (5.654) | | | | (9.382) | (9.604) | (10.413) |
| France | Ref. | Ref. | Ref. | Ref. | | | |
| Germany | -32.241*** | -33.424*** | -28.877*** | -35.182*** | | | |
| | (5.427) | (8.568) | (9.289) | (10.340) | | | |
| Canada | -20.866*** | -26.669*** | -16.629 | -20.061* | | | |
| | (5.871) | (9.210) | (10.458) | (10.763) | | | |
| Constant | -3.456 | 6.951 | 3.874 | 8.362 | -14.653*** | -26.017*** | -20.043*** |
| | (4.827) | (5.641) | (5.225) | (6.579) | (5.425) | (5.533) | (5.954) |
| N. of obs. | 9408 | 3024 | 3360 | 3024 | 3024 | 3360 | 3024 |
| R-squared | 0.232 | 0.244 | 0.262 | 0.205 | 0.169 | 0.288 | 0.177 |
| Max tax revenue | 62.30% | 55.75% | 70.80% | 62.20% | 58.55% | 63.95% | 63.85% |

**Table 8: Elasticity of tax revenue**

| | Leviathan | Public good | Redistribution |
|---|---|---|---|
| $\eta_{10,20} = \eta_{15}$ | 0.96 | 0.95 | 0.97 |
| $\eta_{40,50} = \eta_{45}$ | 0.85 | 0.75 | 0.87 |
| $\eta_{60,70} = \eta_{65}$ | -0.27 | -0.05 | 0.38 |
| $\eta_{80,90} = \eta_{85}$ | -2.32 | -1.33 | -0.74 |

The elasticity of tax revenue, $\eta$, is computed from estimates of $R(t_i)$ and $R(t_{i+1})$ at two adjacent tax rates $t_i$ and $t_{i+1}$, at the four midpoints (15%, 45%, 65% and 85%), by the formula: $\frac{[\hat{R}(t_{i+1}) - \hat{R}(t_i)]/[(\hat{R}(t_i) + \hat{R}(t_{i+1}))/2]}{[t_{i+1} - t_i]/[(t_i + t_{i+1})/2]}$

In column (1) of Table 7, we observe significantly lower tax revenues in Germany and Canada compared to France. Tax revenues are also statistically significantly lower in the Leviathan than in the redistribution treatment.

Results from column (1) confirm that tax revenue increases with the tax rate and the statistically negative coefficient estimate on the ¨tax-rate-squared¨ variable support an inverted U-shaped relationship between tax rate and tax revenue that is a Laffer curve. Coefficient estimates on these variables are statistically significant in all columns of Table 7, confirming a Laffer curve for all treatments and countries. The tax rate for maximum tax revenues is respectively 55.75% for the Leviathan, 62.20% for the public-good, and 70.80% for the redistribution treatment. The elasticity of tax revenue, computed in Table 8, yields a similar picture of the situation. Tax rates above 80% are devastating in the Leviathan case. Those results confirm our conjecture H1b.

## 5. Conclusion and Discussion

Research in behavioral economics has investigated how labor supply and tax revenue are influenced by income taxes. This current study investigates to what extent taxpayers' decisions are influenced by the use of tax revenue by comparing treatments in which tax

revenue is burnt with a treatment where part of the tax revenue is redistributed or used to finance a public good. We also study how attitudes toward taxation and use of the tax revenues, affecting labor supply, vary across individuals of different countries: Canada, France, and Germany.

We have four main findings. First, consistent with previous findings, we observe that the labor-supply curve falls as the tax rate increases. However, the decline of effort with rising tax rates is less monotonic than predicted by our simple and stylized model. In particular, participants make more effort than expected for high tax rates. We also observe a break at the 50% tax rate, the slope being steeper for tax rates above 50% than for lower tax rates. A possible interpretation of this finding is that participants may feel unfairly treated when the tax rate is above 50% such that they are deprived of more than half of what they earned from their labor (see Lévy-Garboua et al., 2009). Altogether, consistent with our behavioral predictions, these findings suggest that on average individuals are not tax neutral but rather tax morale.

Second, we find that the relationship between tax revenue and the tax rate is inversely u-shaped (Laffer-curve). This latter finding directly results from the decline of effort with rising tax rates. This Laffer curve phenomenon considerably exceeds the predictable outcome of a standard income-leisure trade-off.

Third, commitment to direct redistribution or the use of tax revenue to provide a public good (like environmental protection) affects both labor supply and tax revenues. Labor supply and tax revenues are significantly higher in the redistribution treatment than in the Global public good and the Leviathan treatments. In our experimental setting, the commitments are credible. Even though in reality, a Leviathan situation where all taxes money is burnt is not possible, the Leviathan refers to mistrust on the final use of taxes collected as perceived by the taxpayers. The experimental data reveal that if effort and tax revenues are largely unaffected by tax rates up to 50%, redistribution plays a significant role in tax rates above 50%. With tax rates above the 50% level, an ex-ante announcement on the use of taxes plays a decisive role on the real effort level chosen by the participants.

The fourth contribution is the study of country-specific effects in Canada, France, and Germany. We find some differences across countries showing that both the average effort and tax revenue are significantly higher in France than in Canada and Germany. Since French participants show a lower level if trust toward their government relative to the

Canadian (in particular) and German participants, the trust levels fail to explain differences in labor supply and tax revenues across countries. Observed differences between countries do not seem to be explained by differences in trust level, inequality aversion, political orientations, or different environmental concerns. Also, as our data show no significant country effect when the tax rate is zero seems to suggest that individuals do not significantly differ in their disutility of effort across countries. A more likely explanation is that French participants may have higher morale with taxation than Canadian or German participants. A possible interpretation may refer to the fact that countries differ in their history of tax morale (Alm and Torgler, 2006). Another interpretation is that countries may have different "anchors" due to their previous experience of taxation (Tversky and Kahneman, 1974). This may be the case for France where the overall tax and all charges on labor are relatively high compared to the other countries.

Some queries and limits of our study must be discussed. We have already addressed that potential labor-supply response to taxation might be biased downward due to the use of a strategy method and the fact that the perception about Greenpeace as a proxy for an environmental public good may differ across countries (see footnote 8). Another objection to this study is that effort choices may simply derive from the fact that participants feel committed to performing the task to please the experimenter perceived as an 'authority' (see Zizzo, 2010, on experimenter demand effects). Levitt and List (2007) also raise the concern that in a laboratory setting, morality issues can affect participants' behavior especially because their actions are scrutinized. Although we acknowledge that such effects may exist, this interpretation is unlikely to account for our results for several reasons. First, we were careful to avoid having our own current students in the experiment, to use no frame in the instructions, and to minimize the interactions between the players and the experimenter.[26] Second, our experiments allowed participants to leave the session sooner if they decided to work less. Thus, they were in a situation of a real trade-off between work and leisure. Third, even if some sort of authority relationship between the participants and the experimenter did still exist, a demand effect could not explain all the differences observed across treatments.

One might also be concerned with the fact that our experimental context is unrealistic: students are choosing their labor supply under different tax rates in the context of a small

[26] A written debriefing questionnaire asking players to describe their strategy does not show any evidence for such a demand effect.

economy. Furthermore, the tax-rate system is a flat tax system, and the redistribution system does not take into consideration equity concerns since all participants receive the same amount from the government, irrespective of their relative income. We acknowledge all these limitations.

To what extent confronting participants with a more complex tax system may lead to differences in labor supply to taxation? Will introducing a more complex redistributions system (for example, a redistribution targeted toward the poorer people) affect the labor supply of participants? Those extensions as well as replicating the experiments with "real" workers rather than students are stimulating agenda for future work.

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**Appendix A:** Instructions (Canada Public Good)

You participate in an experiment in which you can earn money. In addition to the amount that you will earn you will receive a show-up fee.

You are in a group of 16 participants. Each of you can accomplish an individual task, which consists of decoding letters into numbers. Before you do this task you have to decide on the number of letters (**between zero and 540**) that you want to decode. Note that according to our experience about 12 letters can be decoded per minute. The number of letters that you have chosen for decoding will determine how much time you are going to spend in the experiment. The higher the number of letters, the more time you are going to spend in the lab.

For each decoded letter we shall spay you 0.04 CND. Note however, that you have to pay taxes for any decoded letter and that these taxes will be automatically deduced from your earnings. This means that **your net profit will be (1 – tax rate) × 0.04 CND per decoded letter**.

Note that 80 % of the sum of taxes collected in this experiment will be paid to **Greenpeace**.

The experiment software will randomly choose the tax rate. It will be between zero (no taxes and thus a net payment of 0.04 CND per decoded letter) and 100 % (a net payment of zero). To all participants, the same tax rate will apply. Before the tax rate is announced, each of you has to indicate in a table how many letters you want to decode. The table contains—in steps of 5 %—all potential tax rates between zero and 100 %. The randomly chosen tax rate will assume one of these values. The decision form looks as follows.

| Tax rate | Net profit per decoded letter | Your decision: number of letters to decode |
|---|---|---|
| 0 % | 0.040 | |
| 5 % | 0.038 | |
| 10 % | 0.036 | |
| 15 % | 0.034 | |
| 20 % | 0.032 | |
| 25 % | 0.030 | |
| 30 % | 0.028 | |
| 35 % | 0.026 | |
| 40 % | 0.024 | |
| 45 % | 0.022 | |
| 50 % | 0.020 | |
| 55 % | 0.018 | |
| 60 % | 0.016 | |
| 65 % | 0.014 | |
| 70 % | 0.012 | |
| 75 % | 0.010 | |
| 80 % | 0.008 | |
| 85 % | 0.006 | |
| 90 % | 0.004 | |
| 95 % | 0.002 | |
| 100 % | 0.000 | |

When all participants have filled in this table, the computer program will announce the randomly chosen tax rate. This tax rate will apply to the entire group.

You need to decode the exact number of tokens that you have indicated for the randomly chosen tax rate. If you do not fulfill your commitment, you will receive **no** payment for your participation in the experiment, not even your show-up fee and your payment for your allocation decisions at the beginning of this session.

After completion of you decoding tasks you will receive your payment, and you may leave the lab. Each of you may leave independently of the other participants. How long you will stay depends on your choice of the number of letters to decode. You need not wait until all of the other participants have completed their tasks.

**Your payment** for the completion of the decoding tasks is determined as follows.

$$(1 - \text{tax rate}) \times 0.04 \text{ CND} \times \text{number of decoded letters.}$$

In addition to this, you will receive your show-up fee and your payment for the allocation decision.

The **payment to Greenpeace** will be calculated as follows.

$$0{,}8 \times (\text{tax rate} \times 0.04 \text{ CND} \times \text{sum of decoded letters by all 16 participants})$$

After the experiment, we shall transfer this sum to Greenpeace as an online donation and send you a copy of the receipt by e-mail.

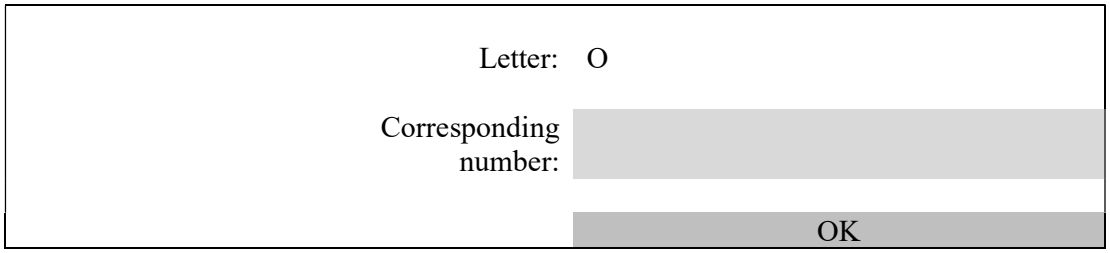
## The decoding task

If you have chosen to decode a positive number of letters, you will receive a sequence of pages—the number of pages being equal to the number of letters chosen. On each page, you will find on the left-hand side a table with 26 letters in one column and 26 corresponding numbers in another column. Both columns show entries in random ordering and correspondence.

| Letter | Corresponding Number |
|---|---|
| C | 1 |
| W | 12 |
| B | 11 |
| K | 17 |
| L | 7 |
| H | 22 |
| O | 9 |
| X | 5 |
| I | 8 |
| A | 19 |
| F | 2 |
| P | 14 |
| R | 25 |
| Q | 6 |
| D | 18 |
| U | 15 |
| S | 3 |
| M | 10 |
| V | 4 |
| E | 24 |
| J | 20 |
| Z | 13 |
| N | 16 |
| Y | 23 |
| G | 26 |
| T | 21 |

This table provides a corresponding number next to each letter.

In the decision box in the middle of the screen, you will see a **letter** for which you are requested to enter the **corresponding number**. Please confirm with <OK>. If you have not entered the correct number, you will receive an error message, and you will be asked to enter a new number.




If you see the letter O you will have to enter in this example the number 9.

In the box on the right-hand side of the screen you see the number of letters that you have already decoded successfully out of the total number of letters that you have committed to decode, as well as the remaining number of letters to decode.

Click <Continue to questions> to answer to some questions regarding your understanding of these instructions. If questions remain, please give us a sign. The experiment personal will come to answer your question. Then you can begin the experiment.

**The mission of Greenpeace (http://www.greenpeace.org/canada/en/About-us/Mission/)**

Greenpeace is an independent, nonprofit, global campaigning organization that uses non-violent, creative confrontation to expose global environmental problems and their causes. We challenge government and industry to halt harmful practices by negotiating solutions, conducting scientific research, introducing clean alternatives, carrying out peaceful acts of civil disobedience and educating and engaging the public. Greenpeace's goal is to ensure the ability of Earth to nurture life in all its diversity.

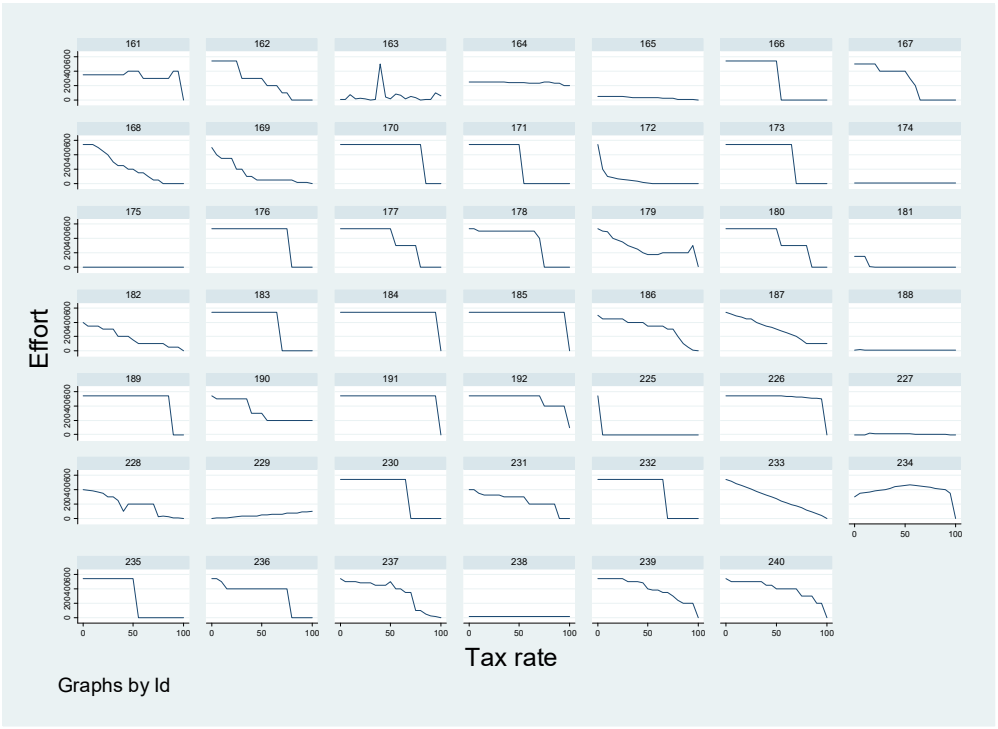
Greenpeace seeks to:

- Protect biodiversity in all its forms;
- Prevent pollution and abuse of our oceans, land, air, and water;
- End nuclear threats; and
- Promote peace and global disarmament.

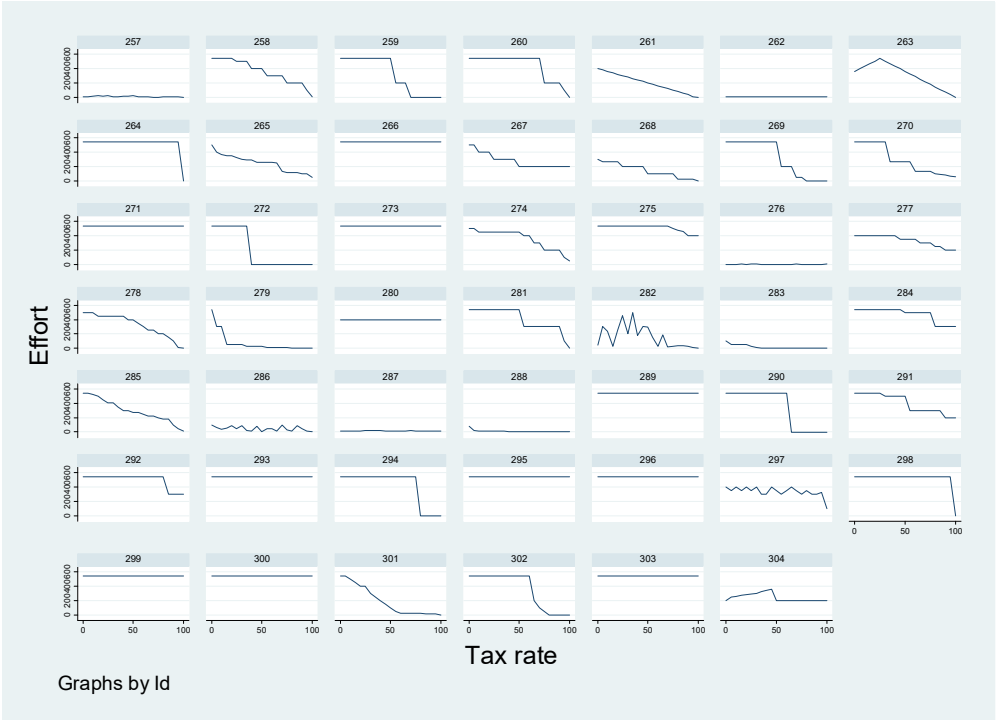
## Appendix B. Individual effort choices

### Figure B1. Individual effort choices per treatment

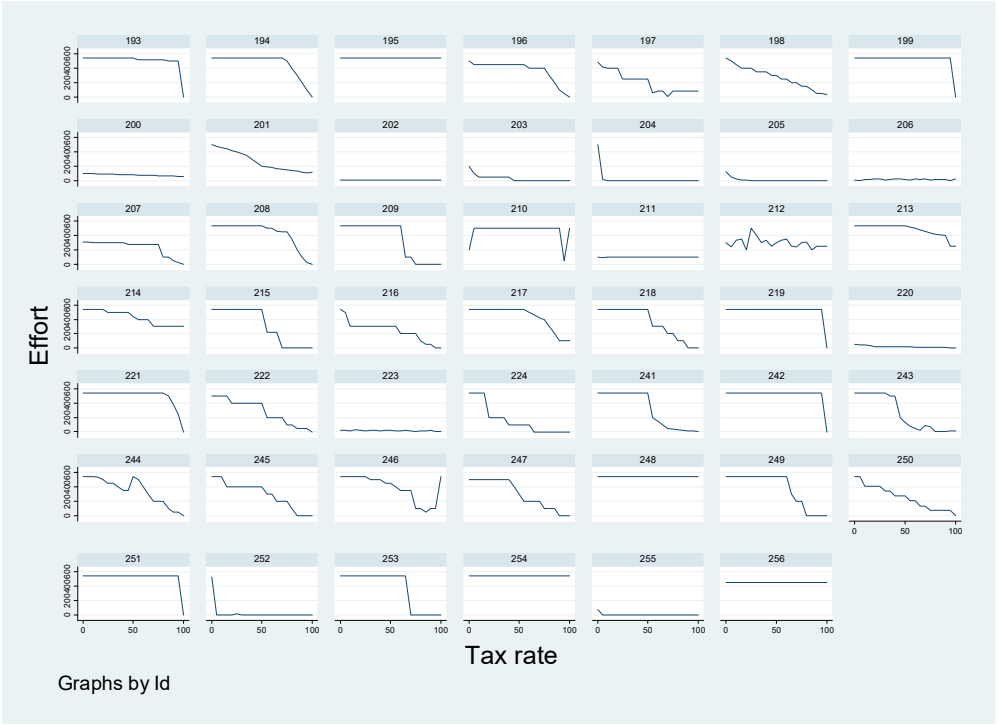
**a. Individual effort choices (Canada Leviathan)**



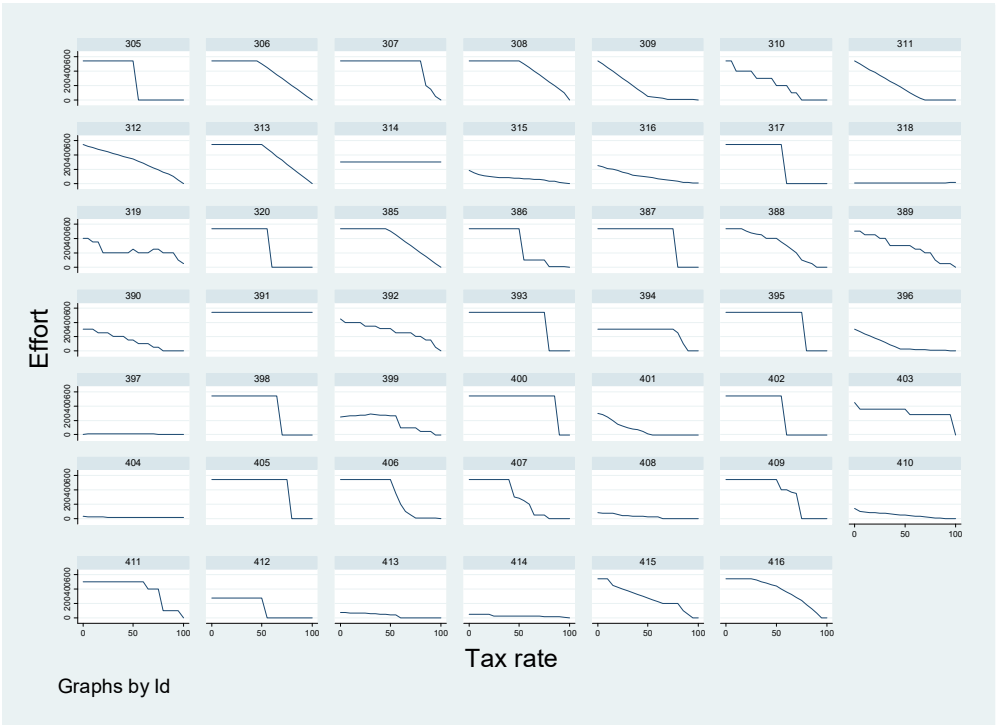

**b. Individual effort choices (Canada Redistribution)**



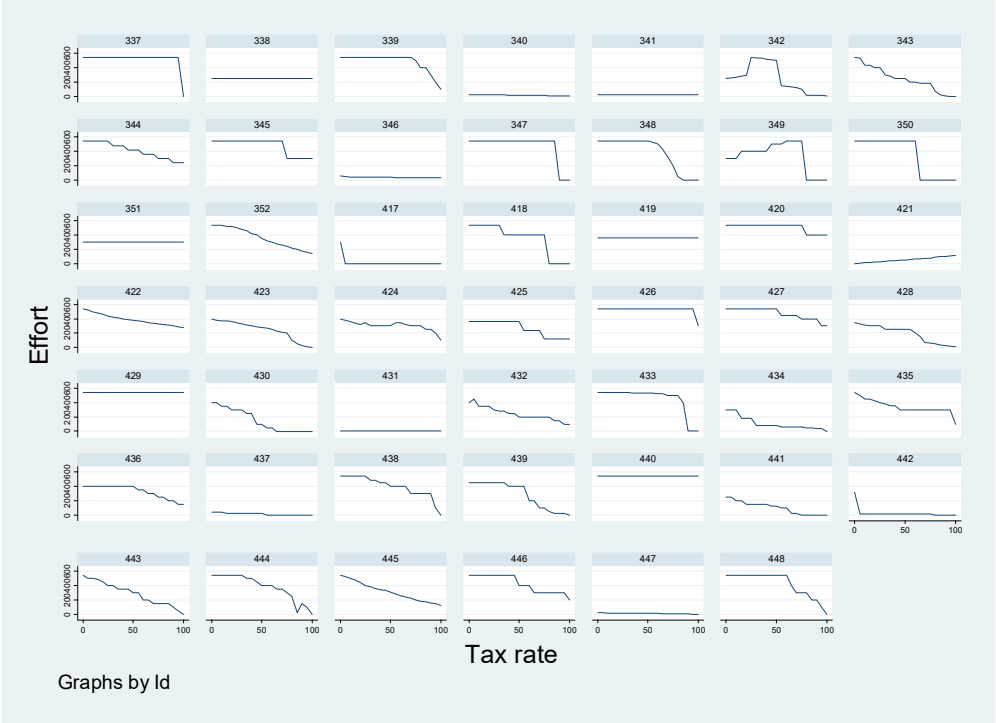
**c. Individual effort choices (Canada Public Good)**



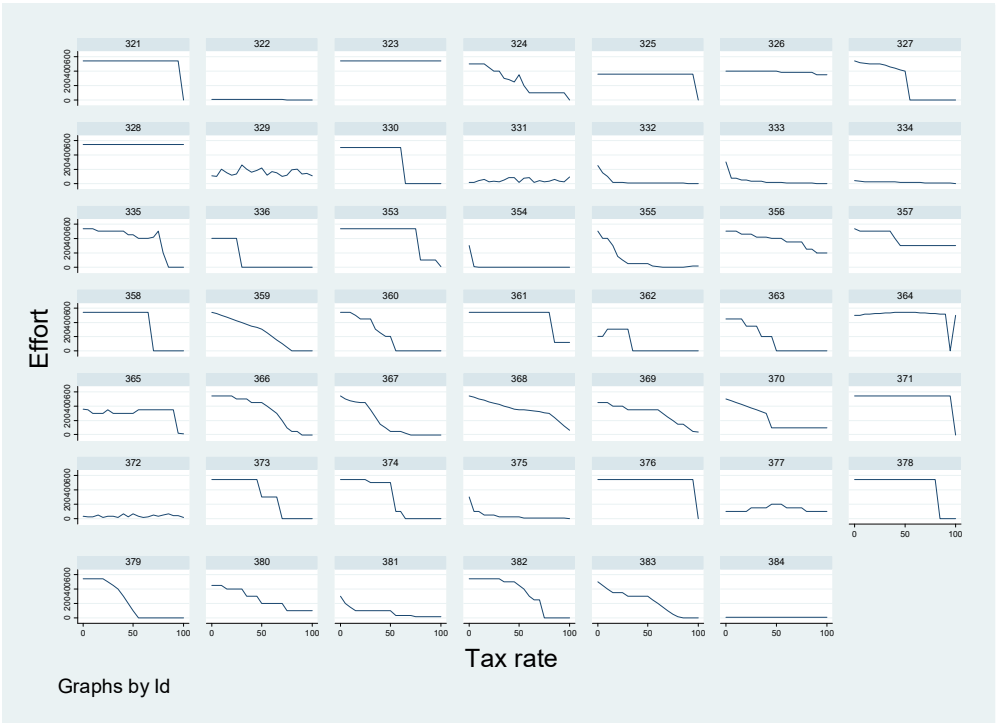

**d. Individual effort choices (Germany Leviathan)**



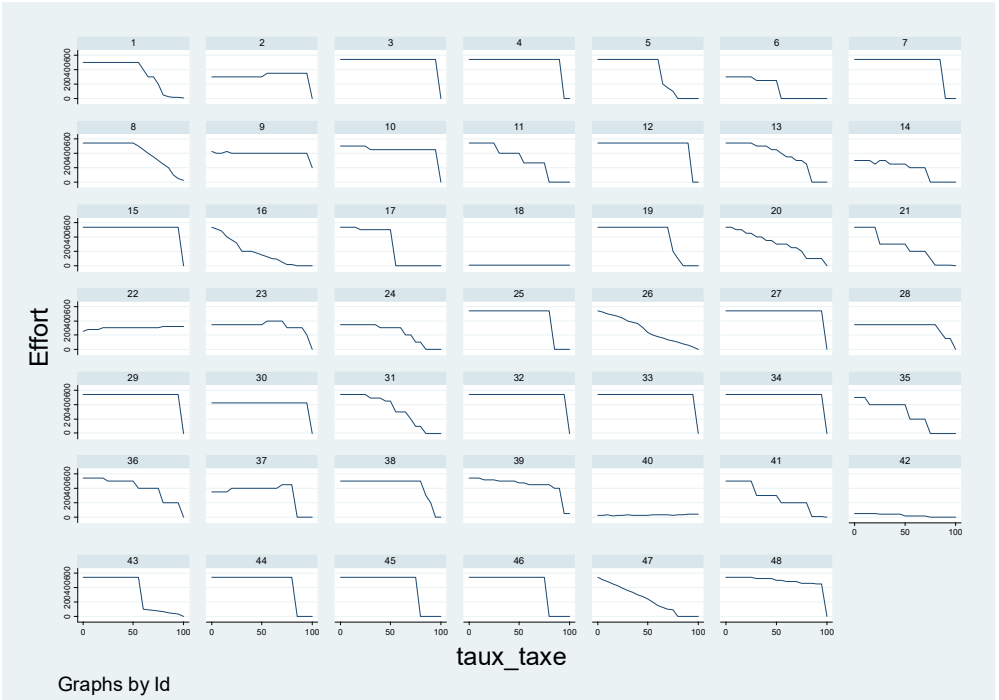
**e. Individual effort choices (Germany Redistribution)**



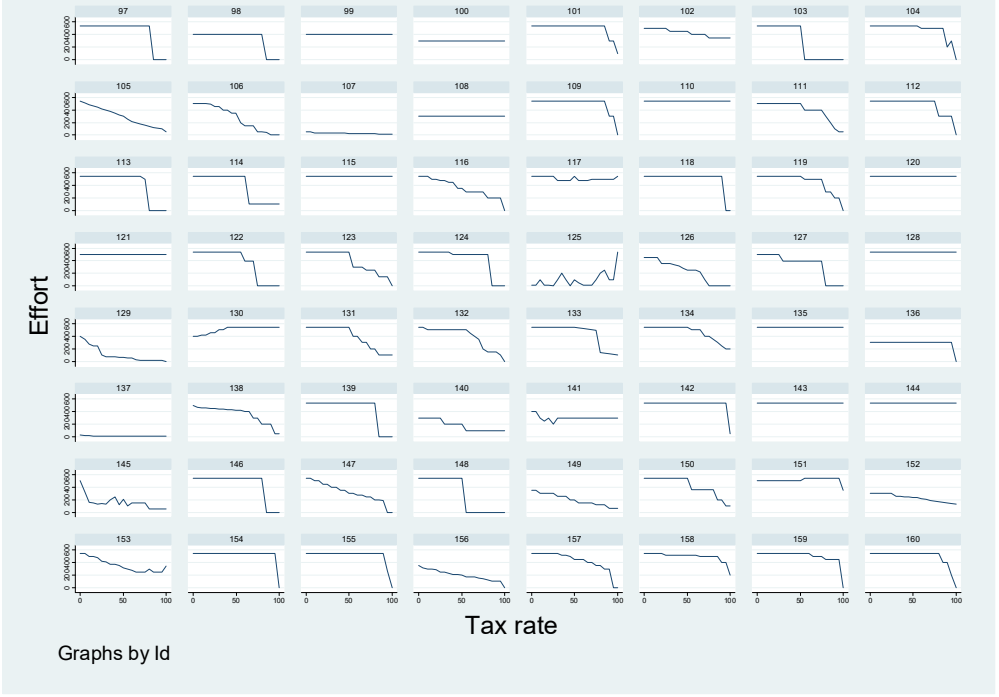

**f. Individual effort choices (Germany Public Good)**



**g. Individual effort choices (France Leviathan)**




**h. Individual effort choices (France Redistribution)**



**i Individual effort choices (France Public Good)**

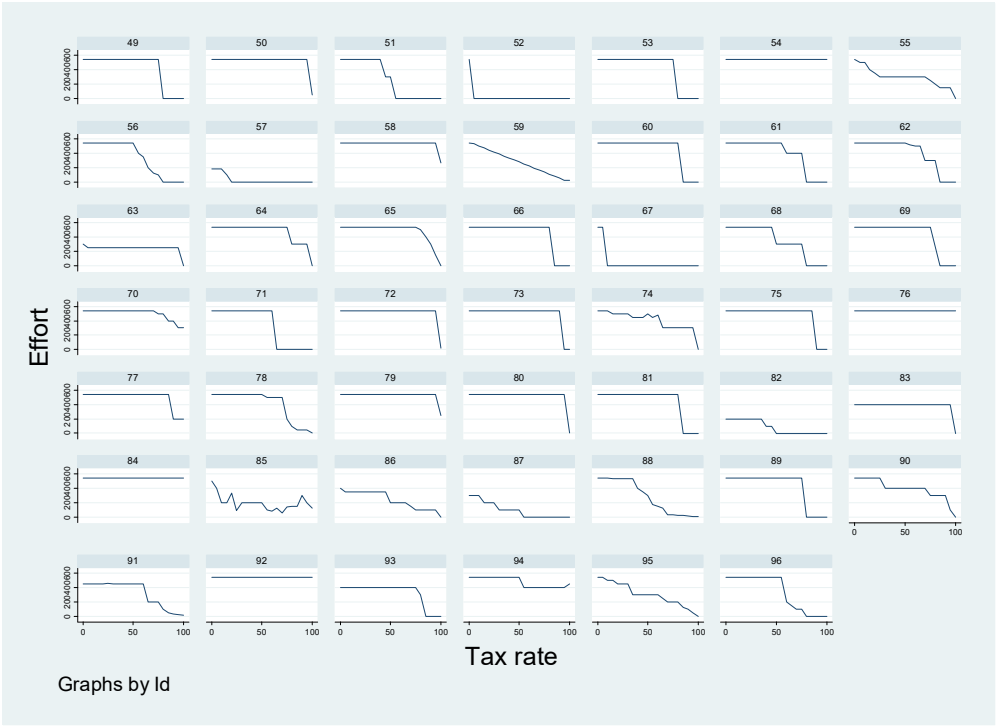
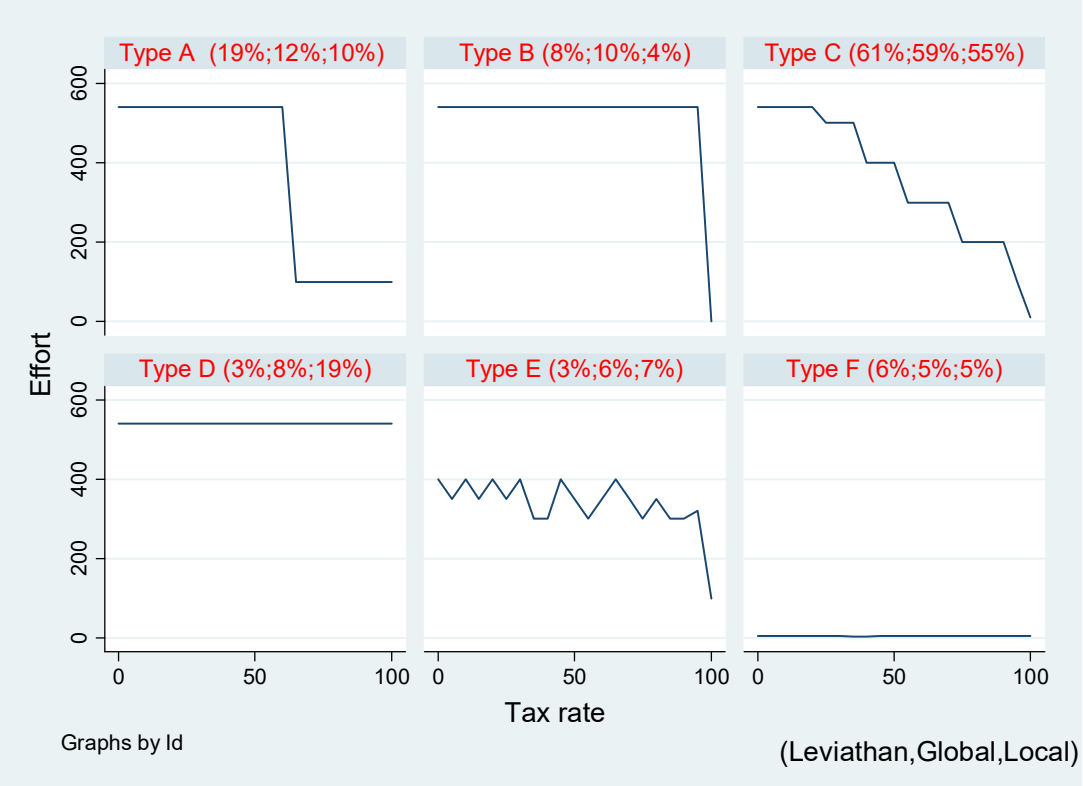


**Figure B2. Typology of individual effort choices per treatment**




Note: This classification is drawn from Figure B1. It is based on clustering using similarities and minimal distances to form some typology. Types A, B and C might be considered as "theory conform" in showing a decline, D and F as "constant effort" and E as "arbitrary effort".