A Game and an Experiment

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Abstract: The authors created an economic experiment, which later was gamified. The aim of the experiment was to measure the causes and motives of tax evasion. The multiplayer decision game identifies factors which can influence tax morale. In order to define these factors, we created the rules of the game based on how citizens make their decisions so we are able to describe and measure the factors bearing influence on their behaviour. How do taxpayers think about paying taxes? In what ways is it significant? The observation of this sensitive topic can be rather challenging. This publication describes the conceptual model that is based on theories built into our game. We defined a new method that measures taxpayers' behaviour in real life situations. Applying tools of gamification, a new experimental game was designed. Further experiments have already been started, whose theoretical background is published in this present study.

Keywords: Taxpayers' behaviour, Gamification, Tax Evasion, Public Game, (Non-) Cooperation

JEL Classification: C72, E62, H26, H30

1 Introduction

Since Richard Thaler received the Nobel Prize in 2017, the popularity of behavioural economics has risen sharply, and both international and Hungarian literature [10][15] has widely reviewed the model of homo economicus, the rational image of man Thaler calls Econ [16]. Such qualities can be attributed to the individual (new image of man) he simply calls Human which can be observed in everyday behaviour or decisions, often through instinctively used heuristics. The interdisciplinary fields of economics and psychology can be observed to be merging in the novel behavioural economics. This decision maker is already

Human, with the feature of a desire to play games, and thus we can introduce a new image of man, i.e. homo ludens (playing man). The playing man (see the summary [13]) has the basic need of sensible, free game – in a space where competition is carried out in a safe, closed environment (not real, but hypothetically seeming real). In this present article, we attempt to create a game to test the homo ludens in situations typical of Humans.

Throughout our work, we designed an experiment to measure willingness to pay taxes, which we later gamified. Our objective is to utilize information gained from the game, and to measure people's real attitude to paying taxes. In short, we created a game to measure willingness to pay taxes. Following the adaptation of information gained from the game, we will have information about what decisions people make when contributing to public goods.

Arthur Laffer supposed that when tax rates are too high, economic operators become inactive [8][17]. Laffer and others concluded that excessive, unjustly high tax rates cause a wide gap between gross and net wages, leading to lower productivity, lower incomes and, consequently, lower budget revenues.

During experiments carried out in Montreal's Lub3-CIRANO Laboratory, Louis Levy-Garboua, David Masclet and Claude Montmarquette [4] were testing the rule known as the Laffer curve. Garboua et al. presumed they had found proof of the existence of the behavioural Laffer curve and that their findings accord with those of Sutter and Weck-Hannemann [14]. Results supported the supposition that in case of endogenous experimental conditions, social norms punish too high tax rates, while they do not punish too low ones. Based on the results of the experiment, the shape of the Laffer curve accounted for both the fair tax rate, as a focal equilibrium point, and the extent of emotional intensities. Tax revenues showed significant differences when tax rates were intentional, and not random. Experiments have shown that with both endogenous and exogenous experimental conditions, employees react dynamically to changes of tax rates (all participants expected a fair taxing behaviour towards social norms). The correlation between the willingness to be employed and the changes of tax rates was independent of whether particular tasks were taxed intentionally or at random. The intensity of the reaction depended on the growth in tax rates and the number of job opportunities defined during the experiment. Based on the results, experimenters found that punishment and tax evasion were of a similar extent to that of the game of public goods, where players can maintain or avoid co-operation with other players, in the case of a low expected income [4]. Persons with higher incomes, however, are significantly more sensitive to changes of tax [7]. During the experiments, this phenomenon was modelled through increasing the available income and the number of tasks that can be performed.

Concerning public goods, Human can mostly be observed in the form of the free-rider behaviour. The theory of the free-rider problem is the most widely applied theorem to describe the relationship between groups and the contribution to public

goods [5][11]. The free-rider problem states that, according to the Nash prediction, what serves citizens best is a non-contribution to public goods [1].

James Andreoni's [1] public-goods game experiment was searching for the answer to whether the free-rider problem is explained by experience gained throughout the game or the rational thinking of the participants. Willingness to contribute to public goods was not explained by either the earning process, or following the best strategy. James Andreoni [1] proved that what the game of public goods teaches people is not to behave as free riders, but that there are free riders in the game too. Related research by Ernst Fehr et al. [3] confirmed that a significant ratio of people are conditional co-operators, i.e. they are willing to co-operate, provided their peers act similarly in a high enough number.

Ernst Fehr and Simon Gächter [3] pointed out that a spontaneous and uncontrolled punishing environment leads to a violent reaction of participants, increasing the number of free riders considerably. If participants could punish deviances such as the free-rider phenomenon, contribution to public goods was rising significantly. The free-rider problem evokes negative feelings in co-operative people, urging them to punish free riders.

The extent of redistribution of investment into public goods shows a positive relationship with willingness to cooperate. During the distribution of public goods, agreeing on a strategy and promises of co-operation will generate actual co-operation only if the promise is made by every group member, and the willingness to co-operate becomes the group's identity [2].

2 TAXIVITY

We wished to create the economic experiment we designed in a way that it is suitable for a proper modelling of taxation, participants can make real decisions, and the factors influencing behaviour can be measured. In short, we wish to know what decisions taxpayers make, what determines contribution to public goods and the willingness to pay taxes.

We further wish to specify the traditional economic theory, the phenomenon revealed by the Laffer curve, the willingness to pay taxes, and tax fraud as a phenomenon through psychological and economic theories regarding human behaviour. When designing our experiment, our starting points were the 2008 experiment carried out in Montreal's Lub3-CIRANO Laboratory by Garboua et al. – proving the existence of the Laffer curve –, and James Andreoni's 1988 public-goods game experiment, respectively.

We found gamification of the experiment necessary due partly to the necessary number of experiments – to have an appreciable amount of data available –, and

partly because we tried to avoid the participants getting bored. When designing the game, we did our best to make sure that the actual players playing the game are the participants themselves, and not the leaders of the experiment. A serious argument for gamification was that after the original experiments, participants were paid in real money, while our players need to settle for the experience of the game and token money.

2.1 The Experiments Taxivity is based on

Garboua and his colleagues [4] applied the REGATE program developed by Zeiliger. Pairs and roles were allocated randomly and were not modified later. Participant (A) was the tax collector, Participant (B) the taxpayer. The experiment was made up of 18 periods, and participants did not know how many times they should repeat the game. In each period, Participant (B) solved different computer tasks in which numbers were to be decoded from a grid of letters appearing on the screen. In the case of an internal, endogenous initiative, Participant (A) chose the tax rate out of four options (12, 8, 50 and 79%), which Participant (B) had to pay Participant (A) for their completed tasks. Participant (B) could decide about how much work they wished to complete. Participant (B) was allowed to modify their decision in each period, while Participant (A) could modify the tax rate only in every third period. The successfully decoded tasks were paid for and they formed the base for taxes. A period ended when Participant (B) finished the tasks they had taken on. In the case of an external, exogenous initiative, the procedure was similar except that Participant (A) could not decide about the tax rate, which, out of the four options, was selected at random by a computer. While Participant (B) was working, Participant (A) was playing computer games or reading a magazine. Participant (B) was aware that it was up to them how much of their income they share with their passive partner, since it was Participant (B)'s choice how much work they took on in each period. Both the endogenous and exogenous experimental conditions were further broken down by restricting the number of tasks Participant (B) could fulfil. In a given experiment type, 26 and 52 tasks could be completed. Throughout the experiments, the income available for Participants (A) and (B) depended on the number of tasks Participant (B) carried out correctly. Participant (A) received tax incomes, Participant (B) received the after-tax net income. In the experiments, every correct task was worth 100 ECU (experimental currency units). At the end of the experiments, participants received real money.

Andreoni et al. [1] carried out experiments with traditional public goods. They repeated the simple public goods game ten times. One group consisted of five members. Every participant received tokens of 50 units, which could be exchanged for money, were they invested into private or public goods. Private investments were worth 1 cent per token, while investments into public goods depended on how much the group members had invested. Every such investment

generated 0.5 cents of private income and 0.5 cents of public goods income for each participant. If all five members invested their tokens into public goods, then every participant gained 2.5 cents of social reimbursement (public good income) and 0.5 cents of private income. After investments into public goods, everybody received incomes to an equal extent, whereas private investments yielded an income exclusively for the investor. During the experiment, participants were not allowed to communicate with each other. At the end of each round, only the total amount of public goods was revealed. Participants could easily calculate what the ratio of contribution to public goods was. To examine whether gaining experience or the dominant strategy of participants (the Nash prediction) was decisive, groups were formed in two ways. Partners remained the same throughout all the 10 experiments, while in the case of strangers, the group members changed randomly during each experiment, every group member could take part in the same experiment with the same group members only once.

At the same time, the questions of justice and punishment play an important role in examining the free-rider problem (the dictator game and the ultimatum game developed by Thaler et al. are also based on them). Kahneman, Knetsch and Thaler (1986) proved with experimental situations that in economic decisions, profit-maximizing players place justness before their individual interests, and what is more, they are willing to sacrifice resources or renounce a part of their income so that the ones being unfair to them or to the market players be punished. In our game, they need not give up resources to have their unfair partners punished, the state will do it for them, but during the game, they will find out if any of their partners were found not to have followed the rules, i.e. who the free riders were (benefitting from public goods without paying taxes). At the same time, the extent of public goods depends on taxes paid, so if everyone happens to be a free rider, the state will have nothing to redistribute.

2.2 Rules of the fair Taxivity

Taxivity is a public goods game in which 1 or 2 game masters and 5 players participate in the experiment. Taxivity is repeated through 10 rounds. Every participant gets an income of 5,000, 10,000 or 15,000 in the form of token money in every round, after which they pay tax. The distribution of incomes may seem random, but at the end of the tenth round, every participant receives the same amount of cumulative nominal pre-tax income, i.e. the amount of ten times 10,000. Each round symbolizes one month, and players pay tax after the income received in that given round (month). The state pays out public goods to citizens in the form of money, as the equivalent of healthcare, pension, education and public services. The state (may) check on players' tax payments. The punishment is double the amount of unpaid tax. It is paid by the player checked, and at this point they also receive overpayments (if they had paid more tax than what was specified). The audit examines tax payments of the previous three months, after

which free riding or overpayment lapse. The audited player is chosen by the players themselves, rolling the dice. In the case of a roll from 1 to 5, the player of the given number is audited. In the case of a roll of 6, players do not get audited. Tokens may be invested in public goods through taxpaying. The invested amount is a contribution calculated on the basis of the tax ratio said by the Examiner. The tax rate may be 20, 40 or 60%. Public goods are 75% of twice the taxes to be paid, distributed between players in an equal manner, regardless of individual players having contributed to public goods or not. If the government treasury does not have enough tokens for public services, public goods are not, or only partially paid out. The government strives to cover its liabilities with credit as well, but its transit time lasts for a full round. Earnings of a given round cannot be reinvested in later rounds. The winner is the player having the most tokens by the end of round 10. But who will collect more money: the free rider or the taxpayer?

2.3 Rule of the unfair Taxivity

The above-mentioned rules apply here, with one exception:

"Public goods are 20% of the base of taxes to be paid, distributed between players in an equal manner, regardless of individual players having contributed to public goods or not." Observably, the amount withdrawn by the state (transaction costs of public goods) is outstandingly high; with such costly state activity the extent of redistributed public goods is quite low, while free riding is still risky with the degree of punishment remaining high.

2.4 Experiments with Taxivity

The experiments are repeated in two ways. In one group players are not allowed to communicate, while in the other group conversation is permitted. Following these rules, four types of experiments can be carried out.

3 Hypotheses

Taxivity, the economic experiment and game model, is based on the following hypotheses, which later can be checked with hypothesis testing:

H1: Willingness to pay taxes is affected to a measurable extent by dependent variables built in the experiment, as follows:

H1A. In the case of higher basic income, experiment subjects pay proportionally less tax. Literature: Kahneman and Tversky [6] weighting function. A loss aversion ratio may even be calculated, but the effects of multicollinearity are also

to be considered, since it is also affected by the extent of tax rate, i.e. there will be a link between H1A and H1B.

H1B. In the case of higher tax rate, experiment subjects pay proportionally less tax. Taxpayers punish tax rates deviating from social or group norms. Literature: Laffer effect, a behavioural Laffer curve effect [4][8][17].

H1C. Punishment diminishes the free-rider phenomenon. There is a tight connection with hypothesis H2A, since among individual features it is risk propensity that determines the degree of taxpayers' conditional co-operation with the state and other citizens. [3].

H1D. In the case of unjust conditions, the ratio of tax evaders is proportionally higher. Experiment subjects' willingness to pay taxes is influenced by the redistribution being just or unjust.

H2: Individual features influence willingness to pay taxes.

H2A. Emergence of crime and tax fraud (taxpayers' rational decision to maximize benefits) is influenced by the expected degree of punishment (among others: Theory of Law Enforcement, Graetz-Reinganum-Wilde, [9]).

H2B. Co-operation increases considerably if experiment subjects are allowed to communicate. A significant ratio of people are conditional co-operators, i.e. are willing to co-operate if a sufficient number of their peers do likewise [1][2][12]. Purity of altruism depends on the behaviour of others.

Under H3, we can examine the role of the state, the general government balance, and the free-rider problem and the effect of the Laffer curve on it.

The hypotheses, which later will be integrated in the research as hypotheses to be tested, are marked with the letter H. For the formulation of the hypotheses, it is indispensable that we clearly identify and define the variables to be measured (with precisely assigned measurement scales) and the above-mentioned correlations between them, and the statistical methods mapping the correlations, respectively. These, however, are not identified within the framework of this article. Here the conceptual model (Appendix 1) makes it easier to overview the serious research question and model behind Taxivity as a game.

4 Discussions and Conclusions

The conceptual model of TAXIVITY models human behaviour in a simplified tax environment where the behavioural Laffer effect and the free-rider phenomenon can be examined simultaneously. With the model, we can examine risk propensity of participants, comparing it to their willingness to pay taxes. To measure risk on an individual level, we apply DOSPER (Domain-specific Risk-attitude Scale), a

measuring device developed by Weber et al. [18]. Risk emerges at several points in the game and in the model – an exposition of this, however, does not fit within the framework of this present article.

The model examines the Laffer effect, with random changes made to the degree of taxes to be paid. It enables the regularity of checks, the degree of punishment, and the examination of correlation between taxpayers' risk propensity and willingness to pay taxes.

Examination of the free-rider problem is secured by all measurable factors of the model. When state redistribution is fair and the increase of taxes imposed and the amounts paid out for public goods increase parallelly, we can examine the free rider effect of Human, while in the case of unfair state redistribution, the behavioural Laffer effect can rather be examined.

All of these independent variables will bear an influence on the extent of taxes paid, so the individual, independent variables can be examined individually, or through their collective multicollinear effect – how they affect the willingness to pay taxes, or its degree. Unlike previously, during our research we talk about the free-rider phenomenon when the willingness to pay taxes is damaged, i.e. in a relative ratio, taxpayers pay less tax than what has been imposed.

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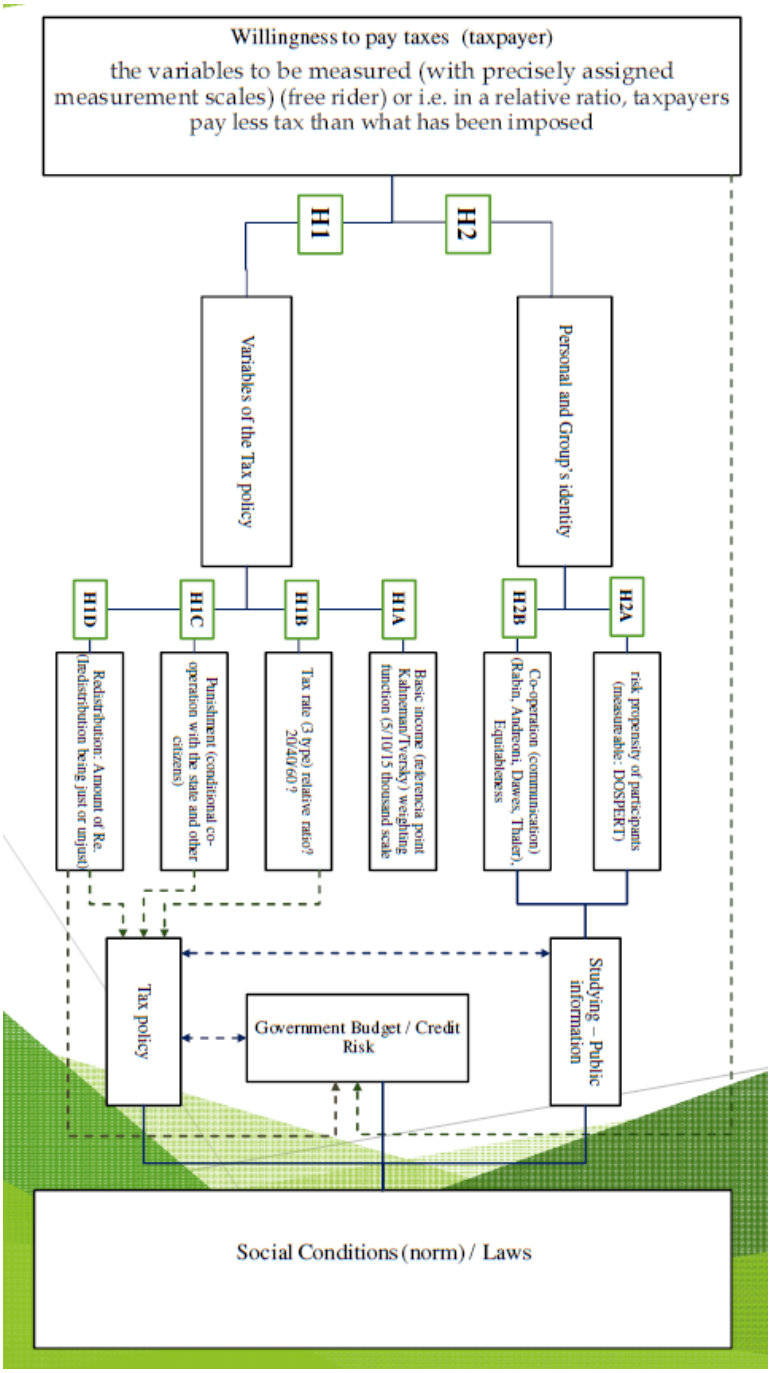
Appendix 1.


Willingness to pay taxes (taxpayer)
the variables to be measured (with precisely assigned measurement scales) (free rider) or i.e. in a relative ratio, taxpayers pay less tax than what has been imposed
H1
H2
Variables of the Tax policy
Personal and Group's identity
H1D
H1C
H1B
H1A
H2B
H2A
Redistribution: Amount of Re. (Redistribution being just or unjust)
Punishment (conditional co-operation with the state and other citizens)
Tax rate (3 type) relative ratio? 20/40/60 ?
Basic income (de'ereucia point Kahneman/Tversky) weighting function (5/10/15 thousand scale
Co-operation (communication) (Rabin, Andreoni, Dawes, Thaler), Equitableness
risk propensity of participants (measurable: DOSPERT)
Tax policy
Government Budget / Credit Risk
Studying – Public information
Social Conditions (norm) / Laws