A NEUROECONOMIC APPROACH OF TAX BEHAVIOR

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Governments around the world register substantial losses due to tax non-compliance behavior. Whether it is tax avoidance or tax evasion, non-compliance has repercussions on the whole society because it mitigates the quality of the provision of public goods. Nevertheless, the level of tax compliance is significantly higher than the classical tax evasion model of Allingham and Sandmo (1972) predicts. A manifold of theoretical and empirical studies invalidate the assumptions of the classical model by trying to give answers to one of the most intriguing questions: Why people pay taxes? Taking into consideration these realities, we summarize some of the findings related to tax behavior within the emerging new field of neuroeconomics. Using state-of-the-art technology (non-invasive brain stimulation, non-invasive measurement of brain activity, pharmacological interventions to raise or lower the activity of neurotransmitters, eye-tracking or skin conductance response), neuroeconomics steps on the scene to give insights on the reasons for which taxpayers display a certain tax behavior. According to the neuroeconomics mainstream literature, emotions guide the decision-making process when outcomes are uncertain with regards to rewards and losses. At neural level, the amygdala triggers bodily states related to reward and loss and the ventromedial prefrontal cortex reenacts past experiences of reward and loss to predict future outcomes. Some taxpayers who decide to engage in tax evasion experience a positive feeling when anticipating the profit from dodging taxes, feeling that is triggered by the amygdala. Other taxpayers don't engage in tax evasion because they want to avoid negative feelings (shame, guilt, regret). Oxytocin facilitates dopamine release which is a positive physiological motivation for cooperation. As a consequence, taxpayers' trust levels increase and, with it, increases the propensity to comply with the tax law. Besides summarizing neuroeconomics findings related to tax behavior, we also draw attention on some policy implications which may derive from neuroeconomics studies and may assist authorities in raising tax compliance levels. Tax evasion is showed to decrease in trustful environments where tax authorities facilitate compliance process and where taxpayers believe their true earnings can be accurately estimated by tax authorities. Tax evasion also decreases when tax authorities publicly denounce tax offenders.
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1. Introduction

When talking about paying tax liabilities, two main types of tax behavior can emerge: compliance and non-compliance. According to Franzoni (2000: 54), compliance behavior encompasses simultaneously the following features: 1) true reporting of the tax base; 2) correct computation of the liability; 3) timely filing of the return; 4) timely payment of the amounts due. Any deviations from the aforementioned features results in non-compliance behavior. Going into depth with the analysis, each main type of compliance can be divided into two sub-types. Tax compliance can be *voluntary* or *enforced*, depending on the nature of factors that influence taxpayers' behavior, i.e., trust in authorities or power of authorities (Kirchler 2007; Kirchler, Hoelzl and Wahl 2008). Tax non-compliance can take either the form of *tax avoidance* or of *tax evasion*, depending on the legality degree of taxpayers' activities, i.e., legal activities or illegal activities. In many countries around the world, the phenomena of tax avoidance and tax evasion reach high levels. Yet, these levels are not as high as the classical model of tax evasion predicts (Allingham and Sandmo 1972) because not all taxpayers are rational utility maximizers. As Alm and Torgler (2009: 635) notice: "Still, the puzzle of tax compliance is not why there is so much

cheating. Instead, the real puzzle is why there is so little cheating. Typically, the percent of all individual income tax returns that are audited is often less than 1% and the penalties on even fraudulent evasion are only a fraction of unpaid taxes. Virtually all economic models of taxpayer behavior conclude that there should be much more tax evasion than is actually observed. However, most people pay most of their taxes most of the time". The present study briefly describes the mechanisms behind decisions related to tax behavior from the neuroeconomic perspective, with the aim of highlighting some policy implications that might contribute to generalize compliance behavior among taxpayers. The remainder of the article has the following structure. Section 2 tackles the key features of neuroeconomics studies. Section 3 describes neuroeconomics results regarding tax behavior and their policy implications. Section 4 highlights the main conclusions of the study.

2. Neuroeconomics: the scientific field of the "economic brain"

One of the newest field among social sciences is *neuroeconomics*, a hybrid between neuroscience, experimental economics and psychology which studies the neural basis of economic decisions. From its appearance in the late 1990s (Glimcher et al. 2009), neuroeconomics caused quite a stir with opinions going from high appraisals and optimistic assessments (Camerer, Loewenstein and Prelec 2004, 2005; Park and Zak 2007; Schultz 2008), cautious conclusions (Bernheim 2008, 2009; Purdy 2006) to harsh critique and deeply rooted skepticism (Gul and Pesendorfer 2008). Nevertheless, neuroeconomics followed its path by: using state-of-the-art technology like *non-invasive brain stimulation* (e.g., transcranial magnetic stimulation– TMS; transcranial direct current stimulation– tDCS), *non-invasive measurement of brain activity* (e.g., functional Magnetic Resonance Imaging– fMRI; Electroencephalography– EEG; Magnetoencephalography – MEG; Positron emission tomography– PET), *pharmacological interventions* to raise or lower the activity of a neurotransmitter (e.g., oxytocin, serotonin), *eye-tracking* (e.g., infrared light cameras), *skin conductance response* (SCR), and applying these techniques to experimental economics game-formats (Smith and Huettel 2010).

According to Fehr and Rangel (2011: 3-4), neuroeconomics investigates three basic questions: a)which are the variables computed by the brain to reach different types of decisions and in what way do they relate to behavioral outcomes; b)how does neurobiology implement and constrain these computations; c)which are the implications of this knowledge for understanding behavior in different contexts (economic, business, legal, political, clinical, etc.). The ultimate goal of neuroeconomics is to provide substantial evidence that will assist economists in developing models based on more realistic assumptions about the decision-making process (Arieli, Ben-Ami and Rubinstein 2009; Zak 2004).

3. Tax behavior from the neuroeconomic perspective: findings and policy implications

Because they examine economic decisions, neuroeconomics studies also focus on tax behavior as an attempt to give more insights into one of the most puzzling economic questions: why people pay taxes (Chorvat 2007). In the case of compliance versus non-compliance, some interesting insights are revealed by the somatic marker hypothesis. This influential neuroeconomics theory states that emotions play an important role in taking decisions whose outcomes are uncertain with regards to rewards and losses (Damasio 1994). According to the theory, bodily states related to different emotions are elicited during decision-making to "mark" some options as advantageous and others as disadvantageous. At the brain level, the amygdala and the ventromedial prefrontal cortex (vmPFC) play distinct but connected roles: the amygdala triggers emotional/bodily states in response to rewards and losses, the vmPFC reenacts past experiences relating to these rewards and losses to predict future rewards (Bechara and Damasio 2005). When taxpayers engage in tax evasion, they are ready to incur the costs of being audited because the profit obtained from not

paying taxes makes them feel good, i.e., the amygdala triggers a positive emotion (Kahn et al. 2002; Zweig 2007; Zweig 2008).

Like any classical public goods game with non-excludable and non-rivaled benefits, taxpaying is no stranger to free-riding, i.e., benefiting from public services without paying, on the efforts of compliant taxpayers. As the optimal allocation of the public good is conditioned by taxpayers' willingness to contribute to the common pool, free-riding propensity could be diminished if governments knew every taxpayer's valuation of the good. Knowing this, governments could compute the optimal level of public goods and tax people proportionally to the benefits they get from these public goods, making sure the benefits exceed the costs (Krajbich et al. 2009: 596). In the attempt to solve the free-rider problem, Krajbich et al. (2009) designed a neurally informed mechanism. By using fMRI, they showed that when it is possible to read subjective states with an accuracy degree ranging from 60%-90% and when tax payments and final outcomes depend on both individuals reported values and neural readings, free-riding decreases dramatically. Indeed, subjects revealed their true values nearly 100% of the time and the public good was provided at a level of 93%. In this case, the only prerequisite is that subjects believe their values can be predicted with sufficient accuracy by technology. Regarding this interesting result, governments could ensure a proper provision of the public goods and a decrease in tax evasion if taxpayers believed their true earnings can be accurately estimated by tax authorities.

One of the groundbreaking discoveries in neuroeconomics is the role oxytocin or "the morale molecule" (Zak 2012) has in facilitating human relationships. Oxytocin is a neuropeptide naturally produced by the hypothalamus. When people trust others, the oxytocin level increases, the midbrain releases a neurotransmitter called dopamine which lowers individuals' anxiety levels and makes people experience a pleasant sensation when cooperating (including with strangers). Due to this sensation, people tend to repeat cooperative behaviors. Studies show that a high level of oxytocin is associated with trustworthiness (Kosfeld et al. 2005; Zak, Kurzban and Matzner 2004, 2005) and it facilitates dopamine release which is a positive physiological motivation for cooperation. Based on these findings, it could be stated that if state authorities would create an environment based on mutual trust and cooperation, taxpayers would be inclined to fully contribute to public funds and tax evasion would be abated.

Regarding the use of eye-tracking in tax related issues, one interesting experiment comes from the corporation *Realeyes* (with headquarters in the US and United Kingdom) specialized in using computer vision to read people's faces and measure their emotions. In order to find out whether UK council websites are designed to ease taxpaying processes, Realeyes asked 54 taxpayers to pay taxes on six different council websites and eye-tracked them. Based on the emotions experienced by the taxpayers that were registered by the eye-tracking devices, the researchers concluded that the UK public sector websites had room for improvement. Three out of the six websites provided a clear and graphically pleasant menu which made taxpaying experience less burdening and facilitated compliance. The clarity of menus also contributed to the lessening of phone calls and e-mails which were addressed to the civil servants and generally implied a lot of time and money. The worst websites had an ambiguous design and very complicated menus. The bright colors used to highlight important information disoriented taxpayers who associated the colored sections with banner ads and disregarded the information. These websites also had a high average of the view to click time (time elapsed between fixating a correct area and clicking on it), which was twice as high compared to the efficient websites and emphasized their unfriendly design. The study had an important eco in the media. As a consequence, after the disclosure of the results one of the 6 councils immediately redesigned the webpage in a user-friendlier manner.

Apart from rationality, emotions also play an important role in decision-making (Coricelli, Dolan and Sirigu 2007). Coricelli et al. (2007) conducted a tax game experiment in which they measured emotions by skin conductance response (SCR) to test the hypothesis that evading taxes

elicits emotions in tax evaders. The experiment had a within-subjects design with two treatments, a first one with monetary sanctions (fines) and a second one with both monetary and non-monetary sanctions (public picture display of tax evaders). The results showed that the relationship between compliance and punishment was mediated by emotions. The amplitude of SCR was higher when underreporting than when complying, especially in the second treatment when evasion decreased significantly. For the subjects reporting between 26% and 75% of their income, the second treatment was more arousing and the strong impact of public picture display was interpreted as shame. According to their study, compliance can be influenced by taxpayers' willingness to avoid negative emotions (shame, regret, guilt). Also, an environment where tax evasion is publicly displayed increases compliance more than an environment with only monetary sanctions. Due to the fact that tax evaders seem to experience negative social emotions, governments could implement policies threatening to denounce cheaters publicly to reduce evasion.

Besides substantial evidence from empirical studies, there are also theoretical approaches. In an article about tax compliance and the neuroeconomics of intertemporal choice, Chorvat (2007) argues that the relationship between the timing of tax payments and the decision of paying taxes impacts on tax compliance more than the standard exponential discounting would predict. This is due to the fact that taxpayers display inconsistent time preferences and apply hyperbolic discounting. Namely, they exhibit higher discount rates between periods of time closer to the current period compared to periods of time in the future. According to Chorvat, tax compliance can be consistently improved by separating the time at which tax returns are filed from the time taxes are paid or refunded.

4. Conclusion

As taxes are ubiquitous in everyone's life, they constitute an endless source for scientific research. Following the stream of literature on tax compliance provided by the social sciences, neuroeconomics offers new insights into the way taxpayers decide whether to comply or not with the tax law. Neuroeconomics studies report that decision-making process is guided by emotions in situations when taxpayers feel uncertain about rewards and losses. These emotions are triggered by the increasing neural activity in the amygdala and the ventromedial prefrontal cortex. The thought of obtaining a profit from not paying taxes makes some taxpayers experience positive emotions and engage in tax evasion. Others fully comply because they don't want to be publicly exposed and experience negative feelings. Some interesting findings state that oxytocin facilitates compliance by increasing taxpayers' trust levels. Although research methodology used in neuroeconomics studies is often criticized by mainstream economists, researchers can benefit from neuroeconomics findings by using neurobiology for developing better models of economic behavior. Neuroeconomics not only can aid future research, but also tax authorities in their attempt to raise compliance levels and decrease tax evasion propensity. Several studies show that the phenomenon of tax evasion is lessened when authorities ensure a trustful environment based on mutual cooperation, in which they denounce tax offenders and are believed to estimate accurately taxpayers' earnings.

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