



# Ambiguity on audits and cooperation in a public goods game<sup>☆</sup>



Zhixin Dai<sup>a,b</sup>, Robin M. Hogarth<sup>c</sup>, Marie Claire Villeval<sup>a,b,d,\*</sup>

<sup>a</sup> Université de Lyon, Lyon F-69007, France

<sup>b</sup> CNRS, GATE Lyon St Etienne, 93, Chemin des Mouilles, F-69130 Ecully, France

<sup>c</sup> Department of Economics and Business, Universitat Pompeu Fabra, Barcelona Graduate School of Economics, Ramon Trias Fargas, 25–27, 08005 Barcelona, Spain

<sup>d</sup> IZA, Bonn, Germany

## ARTICLE INFO

### Article history:

Received 8 August 2014

Accepted 24 November 2014

Available online 23 December 2014

### JEL classification:

C92

H41

D83

### Keywords:

Ambiguity

Audits

Sanctions

Public goods

Experiment

## ABSTRACT

We investigate the impact of various audit schemes on the provision of public goods, when contributing less than the average of the other group members is centrally sanctioned and the probability of an audit is unknown. We study how individuals update their beliefs about the probability of being audited, both before and after audits are permanently withdrawn. We find that when individuals have initially experienced systematic audits, they decrease both their beliefs and their contributions almost immediately after audits are withdrawn. In contrast, when audits were initially less frequent and more irregular, they maintain high beliefs and continue cooperating long after audits have been withdrawn. This identifies the compliance effect of irregularity and uncertainty due to learning difficulties. By increasing both the frequency of audits and the severity of sanctions, we also identify an educative effect of frequent and high sanctions on further cooperation.

© 2014 Elsevier B.V. All rights reserved.

## 1. Introduction

It is well known that the provision of public goods suffers from free-riding (Isaac et al., 1985; Andreoni, 1988; Ledyard, 1995) but that cooperation increases when a decentralized sanction mechanism is introduced (Fehr and Gächter, 2000; Masclet et al., 2003; Bochet et al., 2006; Carpenter, 2007). Although this mechanism is inherently uncertain, it may improve long-term efficiency (Gächter et al., 2008) but only in some instances (Engelmann and Nikiforakis, in press). Moreover, it has also detrimental effects.<sup>1</sup> Replacing peer punishment with legal sanctions (Yamagishi, 1986; Polinsky and Shavell, 2000;

<sup>☆</sup> We are grateful to an Associate Editor and three reviewers for extremely helpful comments. We also thank O. Armantier, N. Houy, K. Konrad, S. Robin, J. R. Tyran, L. Vesterlund, and participants to the workshop on taxation and redistribution at the Max Planck Institute for Tax Law and Public Finance in Munich, to the ESA meeting in New York, the AFSEE meeting in Montpellier, the BEE workshop in Toulouse, and the 11th Journées Louis-André Gérard-Varet in Marseille. This research has been supported by a grant from the French National Research Agency (ANR, EMCO program, HEIDI grant, ANR-11-EMCO-011-01) and was performed within the framework of the LABEX CORTEX (ANR-11-LABX-0042) of Université de Lyon, within the program Investissements d'Avenir (ANR-11-IDEX-007) operated by the French National Research Agency (ANR). Hogarth gratefully recognizes the financial support of the Spanish Ministerio de Economía y Competitividad (Grant ECO2012-35545).

\* Corresponding author.

E-mail addresses: [dai@gate.cnrs.fr](mailto:dai@gate.cnrs.fr) (Z. Dai), [robin.hogarth@upf.edu](mailto:robin.hogarth@upf.edu) (R.M. Hogarth), [villeval@gate.cnrs.fr](mailto:villeval@gate.cnrs.fr) (M.C. Villeval).

<sup>1</sup> The positive impact of a decentralized sanction mechanism on cooperation may be higher when sanctions are more severe (Egas and Riedl, 2008; Masclet and Villeval, 2008; Nikiforakis and Normann, 2008). This mechanism may have a detrimental effect because of a deterioration of altruistic

Andreoni and Gee, 2012), whether deterrent or not (Tyran and Feld, 2006), or with subsidies and taxes (Andreoni and Bergstrom, 1996; Falkinger, 1996) may avoid these effects. In particular, sanctioning negative deviations and rewarding positive deviations from the mean contribution of group members increase efficiency (Falkinger et al., 2000). The mechanism assumes, however, that deviations are measured continuously. Thus, while it removes uncertainty on audits, it may entail excessively high auditing costs and people may suffer from being permanently monitored.

In this paper we study how to improve the efficiency of a centralized sanction mechanism in a public goods game by exploring in a dynamic setting the impact of the (ir)regularity and the frequency of audits when there is ambiguity about their occurrence. Under ambiguity, can less frequent audits sustain cooperation while minimizing their cost? By ambiguity we mean that individuals are not informed about the probabilities of audits but can infer these from experience (Ellsberg, 1961). By varying the pattern of audit sequences, we analyze how individuals adjust their contributions after experiencing a sequence of continuous audits vs. a sequence of less frequent and irregular audits. This allows us to measure the residual effects of various policing regimes over time in order to find the optimal interval between successive controls in terms of compliance. Ambiguity, continuity of audits, and alternation of audit regimes capture important real-world features. Indeed, ambiguity prevails, as authorities typically do not provide information about the probability of audits.<sup>2</sup> There are also many examples of systematic audits (e.g., video cameras at traffic lights, screening of passengers at airports, ticket inspection in railways). Crackdowns illustrate continuous/systematic audits in a dynamic framework. They correspond to episodes of very high officer presence, followed by a sudden drop in controls.<sup>3</sup> More generally, auditing policies are often dynamic.<sup>4</sup>

We hypothesize that cooperation can be sustained longer after experiencing irregular as opposed to long continuous audit sequences. If the probability of an audit is unknown, (ir)regularity might limit the capacity to learn the actual probability and thus, impact the evaluation of costs and benefits of contributing. In a different setting it has been shown that under ambiguity, intermittent reinforcers have greater effects on behavior than continuous ones even after a regime shift.<sup>5</sup> Similarly, learning is much slower when incentives involve probabilistic rather than continuous reinforcement (Bereby-Meyer and Roth, 2006). However, although some studies have found a positive effect of uncertainty on compliance (Friedland, 1982; deAngelo and Charness, 2012; Tan and Yim, 2014), others have shown that less uncertainty may lead to better outcomes. Alm et al. (1992) found a positive effect of uncertainty on compliance when the fines are lost but a negative link when they are redistributed as in a public goods game. It is thus unclear *a priori* whether ambiguity and higher irregularity of audits do or do not increase contributions to public goods.

To address this question, we designed a three-player linear public goods game in which negative deviations from the mean contribution of the other group members trigger a centralized sanction in case of an audit. We implemented a relative mechanism because sanctioning negative deviations is consistent with the centralized sanction mechanism proposed by Falkinger (1996) – except that, for the sake of simplicity, we do not reward positive deviations. The advantages of this mechanism are its simplicity and the fact that it does not require more information than other mechanisms (for example, central authorities know the mean reported income in each occupational category; individual deviations from the mean can signal a willingness not to contribute).<sup>6</sup> Also, in sharp contrast with previous literature (Alm et al., 1992; Mittone, 2006; Kastlunger et al., 2009; deAngelo and Charness, 2012), players are not informed about the audit probability; they must infer this from experience. Moreover, while the game lasts 50 periods, a regime shift is introduced by eliminating audits after period 22.

Before the regime shift, the frequency of audits and the severity of sanctions vary across treatments. In the Cont Low Fine treatment (Cont for Continuous), each of the first 22 periods is audited. In the Int 7 High Fine treatment (Int for Intermittent), only seven audits are randomly assigned across periods and the severity of sanctions is tripled (to maintain

(footnote continued)

cooperation (Fehr and Rockenbach, 2003), especially if reprisals are possible (Denant-Boemont et al., 2007; Nikiforakis, 2008; Nikiforakis and Englemann, 2011), or due to anti-social punishment (Herrmann et al., 2008).

<sup>2</sup> In the tax domain, the Internal Revenue Service deliberately maintains uncertainty on its audit selection process (Alm et al., 1992). The complexity of tax codes and their frequent changes also generate ambiguity. In public transportation, the introduction of inspectors in civil clothes aims at increasing ambiguity. Regarding roadway speeding, mobile radars create ambiguity. Baker et al. (2004) give examples of uncertainty in detection probability in law enforcement. Harel and Segal (1999) show that, if sanctions are usually public, stable and predictable, authorities manipulate the probability of detection to produce uncertainty for criminals.

<sup>3</sup> Crackdowns are a ubiquitous feature of real world enforcement (Sherman, 1990; Di Tella and Schargrodsky, 2002, 2004; Kleiman, 2009; Eeckhout et al., 2010; van der Weele, 2012). This applies to tax audits (Slemrod et al., 2001), traffic enforcement, corruption (Di Tella and Schargrodsky, 2002), drug markets (Farrell and Thorne, 2005), and urban violence (Moeller, 2009).

<sup>4</sup> Speed radars or inspections in subways are not always located at the same place, meaning that audits are sometimes systematic and sometimes inexist. The variations in audit regularity may also be non-deliberate, for example in times of budget restrictions.

<sup>5</sup> Psychologists have shown that if organisms are irregularly reinforced during training, the behavior persists longer after the reinforcement has been eliminated compared to continuous reinforcement (Ferster and Skinner, 1957; Hilgard and Bower, 1975). Hogarth and Villeval (2014) provide an economic analysis of this phenomenon applied to positive incentives.

<sup>6</sup> In the domain of mild laws, many examples also show that sanctions are actually implemented when the proportion of non-compliers exceeds a certain threshold (i.e., the trigger is the relative more than the absolute level of fraud). Tax administrations use risk-based methods to concentrate their audits on high-risk taxpayers who are the most likely to be non-compliant. This scoring includes benchmarking vis-à-vis other companies of similar industries (see Gupta and Nagadevara (2007) and Khwaja et al. (2011)). Evaders may be identified when they report incomes that deviate from the mean income of their category. To some extent it is the individual deviation from the average behavior of taxpayers with the same attributes that triggers the audit, and thus the sanction. Here, deviations from the average behavior do not condition the probability of being audited but the intensity of sanctions when audited.

Download English Version:

<https://daneshyari.com/en/article/5066655>

Download Persian Version:

<https://daneshyari.com/article/5066655>

[Daneshyari.com](https://daneshyari.com)