



# Judicial error and cooperation <sup>☆</sup>



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## ABSTRACT

Cooperation can be induced by an authority with the power to mete out sanctions for free riders, but law enforcement is prone to error. This paper experimentally analyzes preferences for and consequences of errors in formal sanctions against free riders in a public goods game. With type I errors, even full contributors to the public good may be punished. With type II errors, free riders may go unpunished. We find that judicial error undermines cooperation and that the effects of type I and II errors are symmetric. To investigate their relative (dis-)like for error, we let subjects choose what type of error to prevent. We find that subjects prefer type II over type I errors. However, the strength of preferences for preventing type I errors is fully in line with a motive to maximize income and does not indicate any additional psychological or fairness bias against type I errors.

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## 1. Introduction

A large experimental literature investigates the capacity of sanctions to promote cooperation in social dilemmas. Most papers focus on informal, decentralized sanctions (e.g. Fehr and Gächter, 2000). Recently, a number of papers focusing on formal, centralized or pooled sanctions have also emerged (e.g. Tyran and Feld, 2006; O’Gorman et al., 2009; Putterman et al., 2011; Traulsen et al., 2012; Zhang et al., 2014; Andreoni and Gee, 2012; Markussen et al., 2014; Grechenig et al., 2015; Kamei et al., 2015). Results from these experiments generally show that sanctions are effective in terms of increasing pro-social behavior, such as contributions to a public good. Whether or not earnings are increased depends on the cost of the sanctions, the gains from cooperation, and whether some cooperation is also sustained in the absence of sanctions.

In the case of informal institutions, considerable attention has been devoted to the issue of mis-targeted sanctions, referred to as “perverse” or “antisocial” punishment, where people are sanctioned in spite of choosing pro-social actions (e.g. Cinyabugama et al., 2006; Herrmann et al., 2008). The experimental literature on formal sanctions has focused much

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less on targeting. Often, it is assumed that formal sanctions are always well-targeted.<sup>1</sup> In fact, formal sanction systems, such as those administered by the state, are not free of error. Judicial error can loom in two basic ways: Sometimes innocent people are punished (type I error) and sometimes those guilty of wrong-doing are not (type II error).<sup>2</sup> We use the term “judicial” as an umbrella term to cover also cases for which “administrative,” “bureaucratic,” “official” or other terms might be applicable as well.

This paper studies in a laboratory experiment how both types of judicial error affect contributions to a public good when free riding is subject to formal sanctions. We exogenously vary two fundamental properties of the sanctioning environment, namely the probability of error and the severity of sanctions. Furthermore, while previous experimental papers on judicial error have mostly considered exogenous errors, we investigate people’s preferences for type I versus type II errors by letting them choose which type of error to prevent.<sup>3</sup>

Understanding preferences and consequences for types of judicial errors is important for the design of formal sanctioning systems. First, reducing errors is costly. Some types of expenditure, such as increased spending on police investigation, are likely to prevent both type I and type II errors. Other types of spending may have differential effects on the two types of error. For example, improving access to legal assistance for defendants is likely to reduce type I errors, while increased resources for public prosecutors may reduce type II errors. Second, the choice of legal standards and investigation procedures sometimes implies a trade-off between type I and type II errors. A clear example is the “burden of evidence”. To obtain a legal conviction, the defendant must be proven guilty according to some “evidence standard”, with a prime example being that the prosecution must provide inculpatory evidence “beyond reasonable doubt”. Reducing the evidence standard increases the risk of type I errors and decreases the likelihood of type II errors. Also, some types of police operations (e.g. “stop and search” based on racial profiling) may be seen as reducing the risk of type II errors but increasing type I errors, to the extent that being profiled and searched is a punishment in itself.

If reduction of judicial error is costly, and the reduction of one type of error comes at the expense of the other, then it is important to understand (i) how much and when judicial error affects behavior and (ii) what are people’s preferences for one type of error versus the other. The second issue is particularly relevant in democratic societies. It may well be that the two types of error have similar effects on preventing crime but that the population has a preference for preventing one type of error over the other.<sup>4</sup> In that case, economic policy will not only be guided by considerations of the cost of reducing errors and effective deterrence but also by voters’ preferences, e.g. their aversion to type I errors (punishing innocent people). But to know whether that is the case, one needs a measure of aversion. Our paper sets out to contribute to answering both of the questions above, i.e. to understanding (i) the behavioral consequences of (one vs. the other type of) error and (ii) the people’s relative aversion against different types of judicial error. The aversion to judicial errors and the consequences of type I and type II errors have not been studied previously in a unified framework in a cooperation context, to the best of our knowledge.

Experimental methods are particularly apt for investigating both of these questions. The ability to know payoffs, error probabilities and information conditions and to vary them in a controlled way is a key advantage of experiments. In addition, we implement an incentive-compatible mechanism for eliciting preferences for preventing one type of error rather than the other. We investigate the issue in the context of a public goods game because it is a well-established workhorse in the experimental literature and because it closely corresponds to relevant instances such as obligations to pay taxes, refrain from polluting or attend compulsory military service — obligations people are compelled to fulfill by the threat of penalty, in many cases including judicial sanctions. Another example is team production, where a manager may be charged with the responsibility to monitor team members’ effort and potentially sanction free riders, for example by firing them or withholding promotion or bonuses.

Our main results are as follows. First, we find the usual, inefficient under-provision of public goods absent sanctions, and

<sup>1</sup> Note that experiments on centralized authority differ from one another in the way they represent that authority. In some papers it is fully automated (i.e. written into the experimental software, as in e.g. Yamagishi (1986)), in others it is played by an experimental subject (e.g. Gülerk et al., 2009; Heijden et al., 2009; Nosenzo and Sefton, 2014 and one treatment in Carpenter et al. (2012)). In the latter type of experiment, mis-targeted sanctions may occur, but their nature and frequency cannot be controlled by the experimenter.

<sup>2</sup> There is no strong convention on this way of using the terms “type I” and “type II” error. For example, Harris (1970), Png (1986) and Polinsky and Shavell (2000) use the opposite definition of the one stated here. However, the papers most closely related to ours (e.g. Rizzolli and Stanca, 2012 and Dickson et al., 2009) use the terms in the same way as we do. As noted by Dickson et al., 2009, one argument in favor of our definition is that it parallels the terms type I- and type II error in statistics. In legal matters, the “null hypothesis” is that the defendant is innocent. A type I error, by our definition, is the rejection of a true null-hypothesis (conviction of an innocent), while a type II error is the failure to reject a false null-hypothesis (not convicting a guilty defendant).

<sup>3</sup> We may distinguish between two different sources of judicial error, namely “errors of observation” (i.e. the information that reaches the sanctioning authority is flawed) and “errors of execution” (i.e. the authority commits errors in her use of the information received). We do not explicitly distinguish between errors of observation and errors of execution in the experiment presented here, but one way to interpret our design is that the authority receives flawed information but always reacts to the information as if it was true (i.e. always punishes those that are presented as free riders and never punishes those appearing as contributors).

<sup>4</sup> In general, the extent to which people’s preferences for an institution are derived from its effects on efficiency in material payoff terms is an empirical question. For example, Camerer and Lovo (1999) let experimental subjects choose whether to enter a competitive or a non-competitive environment and find that people choose competition much more often than what would be efficient. Similarly, Fehr et al. (2013) present an experiment where subjects choose between delegating decision making power to another subject or keeping it themselves and find that people delegate significantly less than predicted on the basis of assuming efficiency maximization. Section 2 below discusses various reasons why people may have a stronger aversion to type I errors than predicted merely from the relative effects of type I and type II errors on efficiency.

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