**JOINT LIABILITY IN EVIRONMENTAL LAW: A GAME THEORY APPROACH**

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In the realm of Environmental Law, the use of joint-liability has been proposed as an effective means to protect environment. In particular, we are referring specifically to Laws which consider both the polluter and the landowner (of the polluted area) jointly liable for the damage.

Several examples apply: for example, in the European Union, the Hungarian Law – LII/1995 states that “*liability for environmental damage or an environmental hazard is … to be borne jointly and severally by those who, once the environmental damage or hazard has materialised, own or are in possession (the user) of the land on which the environmental damage or hazard has occurred”,* and the Swedish Environmental Code also prescribes that “*If an operator is not able to carry out or pay for the after-treatment of a polluted property, the person who acquired the property and was aware of the pollution at the time of acquisition or ought to have detected it then shall be liable for after-treatment*”). In the US, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund, statues that the persons liable for an environmental damage are, among others, “*the owner of a facility*”, defining a “facility” as “*any site or area where a hazardous substance has been deposited, stored, disposed of, or placed, or otherwise come to be located*”.

 Legal scholars and Courts have much debated the compatibility of this liability regime with the Polluter Pays Principle (PPP). We can recall the debate among the Italian Administrative Courts which ended with the adjudication by the Supreme Administrative Court (Consiglio di Stato, Adunanza Plenaria, 25/2013).

 The EU Court (c-129/2016) however stated (referring to the Hungarian Law) that such a regime is not only in accordance with the PPP, but it is also a tool for a better environmental protection.

 The question whether the landowner, who did not concretely pollute, should be considered liable or not has already been addressed in the literature (Boyd and Ingberman, 1996), and so is the related issue of judgment-proofness (Shavell, 1986, Boyd and Ingbermann, 1997; Boyer and Laffont, 1996; Balkenborg, 2004).

In this work, instead, we would like to discuss the model of joint-liability in Environmental Law more generally disentangling the underlying strategic interaction between the agents that the Law considers liable. Indeed, even though the landowner did not in fact pollute, she could anyway prevent the pollution by adopting some precautions (for example by monitoring the use of land).

 Some papers in Law and Economics have studied the joint-liability regime (Landes and Posner, 1980; Kornhauser and Revesz, 2009; Tietenberg, T. H., 1989). Although Kornhauser and Revesz partially used a game theoretical approach, they do not model explicitly the strategic behaviours that can come from the interaction between the tortfeasors, in particular when one tortfeasor does not know what the other will do.

 We model the interaction between the tortfeasors as a simultaneous game with incomplete information, starting from some assumptions: *(i)* precautions are assumed to be substitute, i.e. to avoid the harm is sufficient that only one (of the two tortfeasors) takes precautions;  *(ii)* negligence rule is in place; *(iii)* harm occurs whenever precautions are not taken (so we do not allow for a probability distribution over the harm); *(iv)* tortfeasors move simultaneously (for a cooperative game approach, Dehez, P./ Ferey, S., 2013).

 With our results we can test whether a joint-liability produce more or less deterrence than a non-joint-liability ones. The main intuition is that freeriding will occur: if one party thinks that the other will take precautions s/he will not, in turn, take precautions; and in the end no one will take precautions.

Therefore, although joint-liability is usually introduced in order to increase the number of parties who can be responsible for environmental harm, and therefore reduce risks, such a provision would in reality induce less responsibility from agents, resulting in an increase of environmental damages.

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