



Munich Personal RePEc Archive

Investigating Discretionary Environmental Enforcement: a pilot experiment

Germani, Anna Rita and Morone, Andrea and Morone,
Piergiuseppe

"Sapienza" Università di Roma, Università degli Studi di Bari,
Università degli Studi di Foggia

January 2009

Online at <https://mpra.ub.uni-muenchen.de/12735/>
MPRA Paper No. 12735, posted 15 Jan 2009 15:28 UTC

Investigating Discretionary Environmental Enforcement: a pilot experiment

Anna Rita Germani[♦], Andrea Morone[♥] and Piergiuseppe Morone[♠]

ABSTRACT: In this work, we conducted a laboratory experiment in order to test the findings of a theoretical environmental enforcement model played as a strategic game where the firm's behavior is influenced by the course of actions discretionally undertaken by both the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Justice (DOJ).

Our experimental findings suggest that the presence of the DOJ can be counterproductive in increasing social welfare, since it implies solely additional enforcement costs, which, in turn, might reduce the probability of conducting inspections by the EPA without affecting the probability of firm's compliance.

Keywords: classroom experiments, environmental enforcement, environmental economics.

JEL classifications: C90, O13, Q50.

1. Introduction

Enforcement of laws and enforcing institutions are the most crucial elements for the success of any regulatory policy design and should be taken into consideration when formulating policies for promoting social welfare; it is, thus, important, in designing the environmental governance, to adopt institutional schemes able to implement effective environmental policy measures. In the last decade, the enforcement toolbox of U.S. environmental regulators and institutions has been harshly criticized [see, for example, Abbot, 2005] for having a too large amount of discretion, administrative and/or investigative in the hands of the Environmental Protection Agency (from now on, EPA), and prosecutorial in the hands of the Department of Justice (from now on, DOJ). Moreover, several empirical studies have documented how the enforcement of environmental laws is characterized by the fact that some violators are sentenced at criminal level while others, who have in substance committed the same crime, are not punished at all or are sanctioned with a purely administrative or civil fine [Barrett, 1992; Cory and Germani, 2002; Babbit et al., 2004]. This, in turn, raises the question of the effectiveness in terms of firms' compliance in such an enforcement system characterized by a high level of discretion at both administrative and civil/criminal levels.

Nowadays, the U.S. EPA is pushing enforcement activities at all fronts but especially on criminal actions. Such a trend has come under criticism as it has been argued that the fear of

[♦] "La Sapienza" University of Rome – Email: argermani@gmail.com

[♥] University of Bari – Email: a.morone@gmail.com

[♠] University of Foggia – Email: p.morone@gmail.com

being indicted may, in the long run, undermine environmental compliance worsening both the relations between EPA and firms and environmental conditions [Gaynor and Lippard, 2002; Coffee, 1991; Green, 1997]. Moreover, from a theoretical perspective Germani and Scaramozzino [2007] (from now on, G&S) have recently shown how also the presence of the DOJ does not appear to affect the level of compliance by firms.

Departing from this setting, and building on the theoretical model set up by G&S, we shall try to empirically test, by means of a laboratory experiment, the role of the DOJ in deterring firms from polluting. The paper is organized as follows: in the next section, key aspects of the main literature on environmental enforcement are provided; section 3 outlines the experimental model and describes the design of the experiment; section 4 presents the preliminary findings; finally, section 5 offers some concluding remarks.

2. Key references in the literature

The vast theoretical literature on enforcement [e.g. Polinsky and Shavell, 1984, 2000; Posner, 1985, 2003; Shavell, 1993, 2003; Stigler, 1970; Garoupa, 1997, 2001, 2004] shows the fundamental importance of acting upon socially efficient enforcement strategies. As stated by Veljanovski [1984], “*it is legal rules and their enforcement that together shape the incentives and deterrents that attempt to alter the behaviour of those regulated and induce compliance with the law*”. Also, Ayres and Braithwaite [1992] in their seminal work strongly underline how “*the trick of successful regulation is to establish a synergy between punishment and persuasion*”. As it is well known, the basic prescription of enforcement theory is that potential violators behave according to both the probability of being detected and the severity of the sanction. This implies that deterrence may be improved either by raising the sanction, by increasing the expenditures on enforcement in order to raise the likelihood that the violator is captured, or again by changing the legal rules in order to increase the probability of detection [Cohen, 1998]. From an economic perspective, perfect compliance is neither possible nor desirable; since monitoring and enforcement activities are costly for the regulatory authority, the socially optimal level of enforcement has to be found at the point where the costs of law enforcement outweigh the benefits of harm prevention. This is a very crucial point and its importance is demonstrated by the fact that most of the law and economics literature has been focusing on how to best induce compliance at a lower enforcement cost.

Another key element of any regulatory policy is the choice of enforcement actions among those which are available to the relevant institutions (regulators and courts), ranging from administrative actions to civil litigations and criminal prosecutions. Arruñada and Casari [2007] analyze experimentally how different political and judicial institutions may fail to produce enforcement and thus determine market failures. They show that some alternative institutional arrangements may, on the one hand, produce different enforcement results and, on the other hand, provide decision makers with different incentive functions, by encouraging or discouraging enforcement actions.

Unfortunately, the empirical literature on the determinants of firms’ environmental compliance is still very limited, and further investigation into how environmental regulators can influence firms’ compliance in the real world is needed in order to better understand not only what kinds of enforcement actions are more effective in deterring noncompliance, but also in order to learn how to design and implement more efficient environmental measures.

To our knowledge, this work is the first attempt to offer an empirical validation for the efficacy of a combined use of administrative and civil/criminal enforcement approaches. It brings new empirical evidence in the realm of enforcement and discretion studies, by means of a laboratory experiment.

3. The experimental model

As already discussed, our experiment is grounded on the model proposed by G&S where the enforcement problem is modeled as a game where the firm's behavior is influenced by the course of actions discretionally implemented by both the EPA and the DOJ. Specifically, two games are played out: first, the authors consider the game between the firm and the EPA, where the firm can choose whether to comply with environmental regulations or not, by assessing the costs and benefits of compliance *versus* pollution. The EPA, not knowing the strategy chosen by the firm, must decide whether to carry out inspections or not. Then, the authors consider a more complex game, where the EPA can serve a notice of violation to the firm if the latter is found to be non-compliant and the task of environmental control is subsequently taken up by the DOJ - which exercises its discretion deciding whether to initiate a civil or a criminal proceeding. As mentioned above, the authors show that the probability of compliance is unaffected by the presence of the DOJ.

This finding is rather interesting as it shows that firms are deterred in their behaviour solely by EPA's administrative sanctions. Hence, it suggests that the presence of DOJ is just a cost for the society as it does not increase the probability of firms following an environmentally sound behavior.

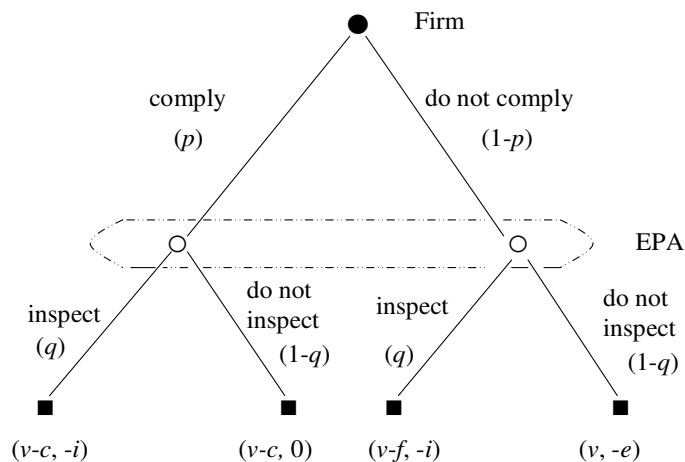
In what follows we shall attempt to test this theory by means of a laboratory experiment; more precisely we calculate the probability of compliance by letting subjects play two experimental treatments which correspond to the two games proposed by G&S and described above - i.e. a treatment without the DOJ and a treatment with the DOJ. We maintain that this procedure will allow us to obtain some interesting results, providing empirical evidence for the theoretical findings of G&S. While stating so, we are aware that this preliminary analysis suffers of two drawbacks: first, the pilot experiment is not incentive compatible; second, we are assuming that all subjects are risk neutral. In future research we shall address both these problems.

3.1 Experimental design

A *paper and pencil* experiment was conducted at the University of Foggia without monetary incentives; participants were first year undergraduate students from the Faculty of Economics.

The experiment builds on the decision problems described in G&S and briefly introduced above. As aforementioned, there are two games corresponding to two experimental treatments. In the first treatment players, acting as firms, play against the EPA (which is played by Nature). Each firm chooses between complying or not whereas the EPA chooses whether to carry out inspections or not. If the firm complies, it has to sustain a cost. The EPA also has to incur a cost if it decides to carry out an inspection (see figure 1).

Figure 1: Strategic game between firm and EPA in extensive form



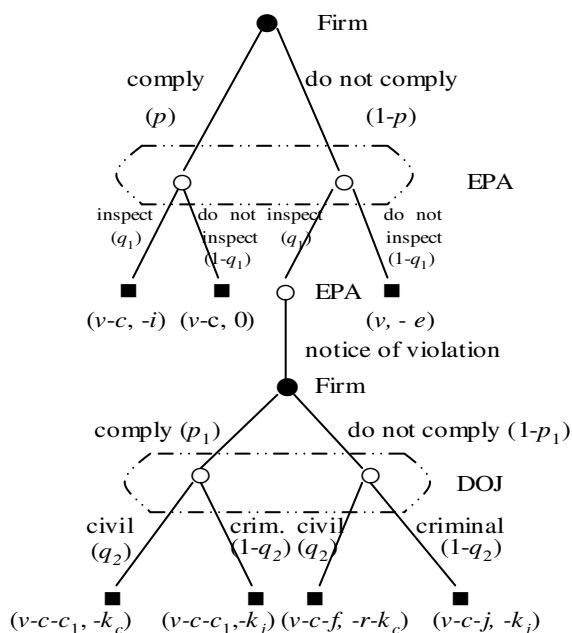
In this treatment we assigned values to the parameters reported in figure 1 as follows: the probability q of EPA starting an inspection was set equal to $1/2$; the value of non-complying firm v was set equal to 50 €; the cost of compliance c was set equal to 5 €; the fine f was set equal to 10 €; the other two parameters reported in figure 1 (the inspection cost $-i$ and the environmental damage $-e$) are not relevant to our experiment as they characterize the EPA pay-off which in the experiment is played out by Nature.

In the second treatment, the EPA can serve a notice of violation to the firm if the latter is found non-compliant. A notice of violation describes the violation and commands the violator to stop the activity.¹ Hence, the task of environmental control is taken up by the DOJ (also played by Nature) - which must then choose between a civil and a criminal prosecution (see figure 2).

In this treatment we assigned values to the parameters reported in figure 2 as follows: the probability q_1 of EPA starting an inspection was set equal to $1/4$; probability q_2 of DOJ starting a civil action was set equal to $5/6$; the value v was set equal to 50 €; the cost of compliance c was set equal to 5 €; the additional compliance cost c_1 , if the firm did not comply in the first instance, was set equal to 15 €; the fine from civil prosecution f was set equal to 10 €; the cost to the firm from criminal prosecution j was set equal to 40 €. Also in this case some parameters reported in figure 2 were not relevant to our experiment as they characterize the DOJ pay-off which in the experiment is played out by Nature (k_c the cost to DOJ of enforcing civil prosecution, k_j the cost of enforcing criminal prosecution, and finally r the reputation cost of letting off an offending firm with only a fine).

¹ The purpose of a notice of violation (NOV) is to initiate a corrective action that will stop the violation. For instance, to provide an incentive for continuing compliance, NOV's for the Clean Water Act may result in monetary penalties up to \$27,500 per day, per violation, according to 33 U.S.C. 1319.

Figure 2: Strategic game between firm, EPA and DOJ in extensive form



We elicit subjects' behaviour using the four pairwise choice gambles reported in figures 3 to 6. The pairwise choice gamble reported in figure 3 represents the firm's decision problem depicted in figure 1 (i.e. treatment 1). On the one hand, if the firm decides to *comply* (see left gamble), whatever the EPA action is, it will get $v-c$ (set in the experiment equal to 45 €); on the other hand, if the firm decides to *not comply* its pay-off depends on the EPA action; more precisely it gets (with probability q) $v-f$ (equal to 40 €) if the EPA decides to *inspect*, and v (equal to 50 €) otherwise (see right gamble).

The pairwise choice gamble reported in figure 4 represents one part of the firm decision problem developed in the second game of G&S and presented in figure 2 above. More precisely, if the firm decides to *comply* (see left gamble), whatever the EPA action is, it gets $v-c$; if the firm decides to *not comply*, its pay-off depends on the EPA's action; if the EPA decides to *not inspect* it gets (with probability $1-q_1$) v ; if the EPA decides to *inspect* and the firm reacts to the EPA's notice of violation by complying, then its payoff will be, independently of the DOJ decision, $v-c-c_1 = 30$ € (see right gamble).

Figure 3: Gambles of the game between firm and EPA



Figure 4: Gambles of the game between firm, EPA and DOJ – first part

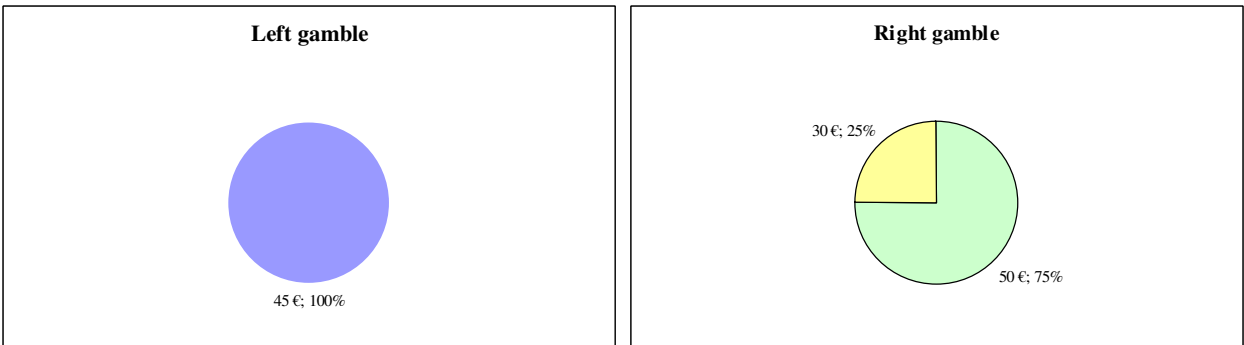


Figure 5: Gambles of the game between firm, EPA and DOJ – second part

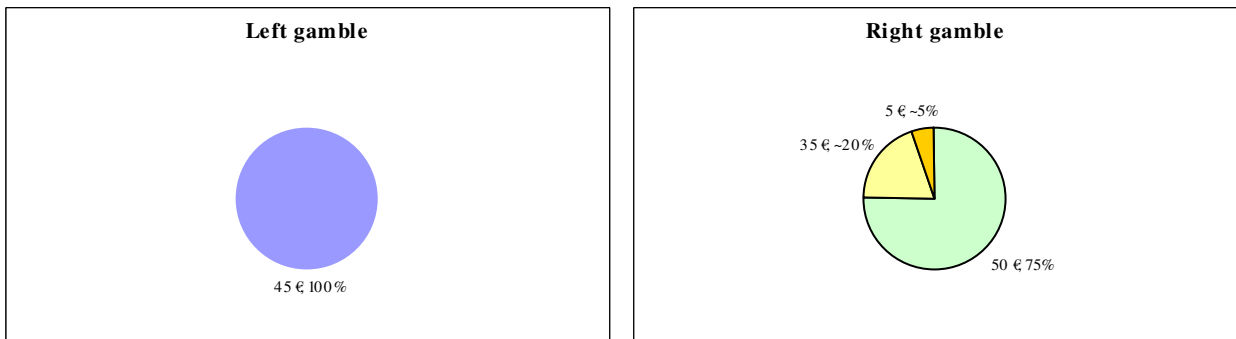
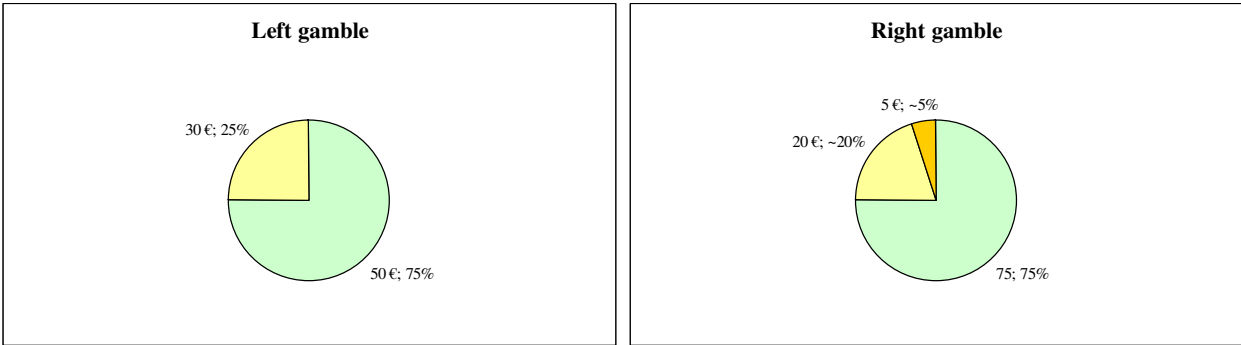


Figure 6: Pairwise choice gambles for the consistency test



The pairwise choice gamble reported in figure 5 represents the remaining part of the firm decision problem depicted in figure 2. As always, if the firm decides to *comply* (see the left gamble), whatever the EPA action is, it gets $v-c$; if the firm decides to *not comply* and the EPA decides to *not inspect*, the firm gets (with probability $1-q_1$) v ; if the EPA decides to *inspect* and the polluting firm does not react to the EPA’s notice of violation by complying, then its pay-off is (with probability $q_1 \times q_2 = 5/24$) $v-c-f = 35$ € if the DOJ starts a *civil* procedure and (with probability $q_1 \times (1-q_2) = 1/24$) $v-c-j = 5$ € if the DOJ starts a *criminal* procedure (see right gamble).

Finally, the pairwise choice gamble reported in figure 6 represents a consistency test, as it allows to verify if subjects’ preference respect the transitivity axiom.

4. Preliminary findings

In this section we present some preliminary findings obtained running a pilot experiment. Out of the 51 subjects that took part in the experiment, two did not pass the consistency test discussed above. One of these two subjects displayed also an irrational behaviour in the second session of the experiment (i.e. when the DOJ was introduced). Henceforth, we drop them both from the database and conduct our analysis on the remaining 49 observations.

As discussed in the experimental design section, we first tested the strategic game between the EPA and the firm; we report results in figure 7. Out of the 49 subjects considered, almost half decided to comply (24 subjects). We then compared this result with those obtained in the second treatment of the experiment in order to test the core finding of G&S - i.e. that the introduction of the DOJ does not affect the probability of compliance and, therefore, that the DOJ represents a net cost for the society.

In the game played among firm, EPA and DOJ, as showed in figure 8, only 11 subjects complied with environmental measures in the first move. This striking result would suggest that introducing the DOJ produces a sharp reduction in the rate of compliance. However, we can observe that out of the 38 subjects that decided to pollute, almost 45 per cent switched to a non polluting behaviour once the EPA notifies the violation.

Figure 7: Subjects' behaviour in the game between firm and EPA

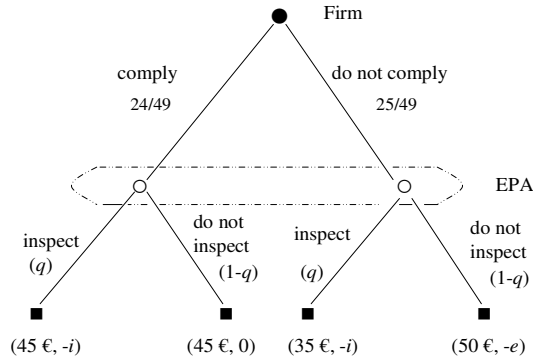
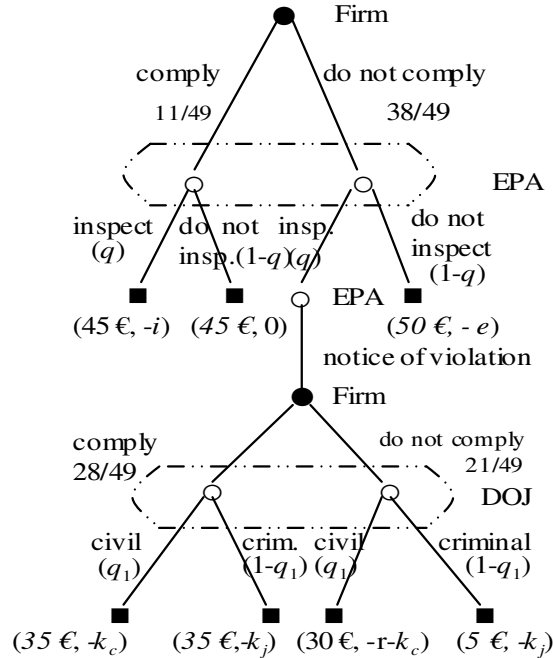


Figure 8: Subjects' behaviour in the game between firm, EPA and DOJ



As set in the G&S model, we know that the probability of inspection (and hence, for those firms who did not comply, of receiving a notice of violation) is $q_1 = c/(c-c_1)$. So, under our experimental parameterization, this probability will be equal to $1/4$. Therefore, we can expect that out of the 38 firms that did not comply only $38/4 = 9.5$ will be inspected by the EPA and then only 4.2 will switch to compliance.

All in all, this adds up to $11 + 4.2 = 15.2$ complying firms, which is less than two thirds of the number of firms that decided to comply in the first game. Hence, we can conclude that the introduction of the DOJ in the game reduces sharply the number of complying firms and, therefore, reduces the efficacy of the enforcement strategy.

In addition, we can calculate the threshold value of q_1 which would lead to an equilibrium in which the same number of firms would comply in both games with and without the DOJ. This value would be 0.76, implying that the EPA should conduct an inspection with a probability of 76%. Note that this probability is higher than that required to obtain the same level of compliance in the game without the DOJ (which was $q = 0.5$). In turn, under the G&S parameterization, our experimental findings suggest that the presence of the DOJ is a cost for society, as it increases the number of complying firms only if the EPA conducts more inspections.

5. Some concluding remarks

Criminal enforcement has always been perceived as a very important tool in deterring anti-social behaviors. However, one of the main criticisms of criminal enforcement is that often civil liability provides sufficient mechanisms of deterrence without involving expensive and protracted litigation costs [Hoffman, 1992]. Some critics have also noted that criminal enforcement does not lead to optimal deterrence because prosecutors are often accused of choosing cases arbitrarily based largely on political motivations [Lazarus, 1995].

Our findings may support such criticism as they show that it is possible to protect the environment without having to recourse to criminal prosecutions. Our results, in fact, provide a first empirical validation of the theoretical outcomes obtained by G&S by supporting the argument that it is more efficient to let the EPA resolve the cases internally (administratively) rather than refer them to the Department of Justice for civil or criminal prosecution. From our experimental test it emerges that the intervention of the DOJ acts merely as an additional enforcement cost, which, in turn, might reduce the probability of conducting inspections by the EPA without affecting the probability of firm's compliance.

This may suggest that some institutional mechanisms (such as that of enhancing criminal enforcement programs) would not necessarily strengthen deterrence since criminal fines might not be able to give polluters the adequate incentives to prevent environmental crimes; criminal enforcement may, indeed, reduce the effectiveness of enforcement policies.

References

- Abbot C. (2005). "The Regulatory Enforcement of Pollution Control Laws", *Journal of Environmental Law*, 17(2):161-180.
- Ayres I. and J. Braithwaite (1992). *Responsive Regulation: Transcending the Deregulation Debate*, Oxford University Press.
- Arruñada B. and M. Casari (2007). "How Enforcement Institutions Affect Markets", ISNIE, April, Reykjavik.
- Babbitt C.J., D.C. Cory, and B.L. Kruchek (2004). "Discretion and the Criminalization of Environmental Law," 15(1) *Duke Environmental Law and Policy Forum*.
- Barrett J. (1992). "Sentencing Environmental Crimes under the United States Sentencing Guidelines: A Sentencing Lottery," *Environmental Law*, 22.
- Coffee J.C. (1991). "Does Unlawful mean Criminal?: Reflections on the Disappearing Tort/Crime Distinction in American Law", *Boston University Law Review*, 193.
- Cohen, M.A. (1998). "Monitoring and Enforcement of Environmental Policy", Vanderbilt University, <http://www.vanderbilt.edu/VCEMS>
- Cory C.D. and A.R. Germani (2002). "Criminal Sanction for Agricultural Violations of the CWA," 4(6) *Water Policy*.
- Garoupa N. (1997). "The Theory of Optimal Law Enforcement," *Journal of Economic Surveys*, 11:267-295.
- Garoupa N. (2001). "Optimal Magnitude and Probability of Fines," *European Economic Review*, 45:9.
- Garoupa N. (2004). "An Economic Analysis of Criminal Law," in *Economic Analysis of Law: A European Perspective*, Edward Elgar, edited by Aristides Hatzis.
- Gaynor K.A. and B.S. Lippard (2002). "Environmental Enforcement: Industry should not be Complacent", *Environmental Law Reporter*, vol. n. 32.
- Germani A.R. and P. Scaramozzino (2007). "Modeling Environmental Discretion through Randomized Strategies", *DeFiMs working paper* n. 83.
- Green S.P. (1997). "Why it's a Crime to Tear the Tag Off a Mattress: Overcriminalization and the Moral Content of Regulatory Offenses, *Emory Law Journal*, 46.
- Hoffman S. (1992). "Criminal Sanctions in Accidental Oil Spill Cases - Punishment Without a Crime", *Nebraska Law Review*, 71.
- Lazarus R.J. (1995). "Meeting the Demands of Integration in the Evolution of Environmental Law: Reforming Environmental Criminal Law", *Georgetown Law Journal*, 83.
- Polinsky A.M. and S. Shavell (1984). "The Optimal use of Fines and Imprisonment," in 24 *Journal of Public Economics* 89-99.
- Polinsky A. M. and S. Shavell (2000). "The Economic Theory of Public Enforcement of Law," 38 *Journal of Economic Literature* 45-74.

- Posner R. (1985). "An Economic Theory of the Criminal Law," 85 *Columbia Law Review*, 1193.
- Posner R. A. (2003). *Economic Analysis of Law*, 6th ed., Aspen Law and Business.
- Shavell S. (1993). "The Optimal Structure of Law Enforcement," 36 *Journal of Law and Economics* 255-287.
- Shavell S. (2003). "Economic Analysis of the General Structure of the Law," in *Foundations of Economic Analysis of Law*, Harvard University Press.
- Stigler G.J. (1970). "The Optimum Enforcement of Laws," *Journal of Political Economy*, 78(3):526-536.
- U.S. EPA, *Compliance and Enforcement Annual Results*, years from 2000 to 2007.
- Veljanovski C.G. (1984). "The Economics of Regulatory Enforcement" in *Enforcing Regulation*, K. Hawkins and J. Thomas (eds), Kluwer-Nighoff.