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Effectiveness of Environmental Law: What Does the Evidence Tell Us?

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EFFECTIVENESS OF ENVIRONMENTAL LAW: WHAT DOES THE EVIDENCE TELL US?

MICHAEL FAURE*

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INTRODUCTION

For a long time environmental lawyers and law and economics scholars have developed theoretical assumptions concerning the functioning of various instruments and their ability to reduce environmental harm and to promote sustainable development.¹ A partially different scholarship has engaged empirical research to examine, at least implicitly, to what extent the theoretical assumptions, on which much of environmental governance² is based, in fact work in practice. This contribution aims to integrate these two approaches by looking at what theory tells about how environmental law should work³ and by, at the same time, incorporating

¹ On the legal aspects of this notion of sustainable development, see NICO SCHRIJVER, *THE EVOLUTION OF SUSTAINABLE DEVELOPMENT IN INTERNATIONAL LAW: INCEPTION, MEANING AND STATUS* (2008). On the role of legal instruments in promoting sustainable development, see generally ENVIRONMENTAL LAW, THE ECONOMY AND SUSTAINABLE DEVELOPMENT: THE UNITED STATES, THE EUROPEAN UNION AND THE INTERNATIONAL COMMUNITY (Richard L. Revesz et al. eds., 2000).

² On this notion of good environmental governance, see generally Michiel A. Heldeweg, *Towards Good Environmental Governance in Europe*, 14 EUR. ENVTL. L. REV. 1 (2005) (discussing environmental legal policy-making in Europe, using the concept of good governance and arguing that major improvements still need to be made).

³ For an excellent recent overview, see generally Richard L. Revesz & Robert N. Stavins, *Environmental Law*, in I HANDBOOK OF LAW AND ECONOMICS 499 (A. Mitchell Polinsky & Steven Shavell eds., 2007).

empirical evidence into the analysis. Many environmental lawyers have of course looked at the empirical evidence concerning the effectiveness of environmental legal instruments, but often these studies dealt with either one specific legal instrument, or one specific legal contact (*e.g.*, one country or legal system).⁴ This article attempts to bring together various studies on many environmental legal and policy instruments in order to provide insights at a more general level on the extent to which particular environmental policy instruments can, under specific conditions, be considered effective.

This contribution therefore does not deal directly with environmental law, but some insights into the empirical evidence concerning the effectiveness of environmental law are provided. To a large extent, this evidence is not provided by lawyers. Indeed, when making environmental law and choosing environmental instruments, environmental lawyers may have many ideas or perhaps even hopes on how environmental law, and more particularly specific instruments, may work in promoting sustainable development. However, less may be known about the effectiveness of the instruments chosen to reach the corresponding goals.

Even though environmental lawyers are probably the species of lawyers most interested in empirical research on the effectiveness of legal and policy instruments, the legal work in this domain remains relatively limited. This is understandable. One reason is that much of this empirical material on the effectiveness of environmental legal instruments is the result of research done not by lawyers, but often by economists or other social scientists.⁵ Hence, these results are often published in journals not directly read by lawyers, and often in a language (for example using mathematics and regression analysis) which is difficult for lawyers to understand. Moreover, much of this empirical research will not generally deal with the effectiveness of environmental law in general, but will look at the effect of one particular instrument on one specific environmental parameter (such as CO₂ concentrations) in one particular country or even region. Results are hence often very country specific. The claim of this paper is therefore

⁴ See, *e.g.*, Alberto Monti, *Environmental Risk: A Comparative Law and Economics Approach to Liability Insurance*, 1 EUR. REV. PRIVATE L. 51, 53 (2001) (exploring a single legal instrument: liability); Jason Scott Johnson, *On the Market for Ecosystem Control*, 21 VA. ENVTL. L.J. 129 (2001–02) (exploring a single legal instrument: regulatory systems); Junyi Shen & Yoshizo Hashimoto, *Environmental Kuznets Curve on County Level: Evidence from China* (Graduate Sch. of Econ. & Osaka Sch. of Int'l Pub. Pol'y, Discussion Papers in Econ. & Bus., Paper No. 04-09, 2004) (exploring a single legal contact: China).

⁵ See, *e.g.*, *infra* note 39 and accompanying text; *infra* note 55 and accompanying text; *infra* note 72 and accompanying text.

not that environmental lawyers should necessarily do more empirical research themselves.⁶ Rather, the message is that, if interpreted correctly, the results of these empirical studies do have an important message for environmental law and policy, since they may allow the fine-tuning of environmental policy instruments based on proven effectiveness or deficiencies in practice.

The goal of this contribution is therefore twofold. First, some empirical results concerning the effectiveness of various environmental policy instruments are presented. However, so much has been published on this subject that one could easily fill an entire volume of this review with just that. This overview will thus entail a great degree of “cherry picking,” whereby merely a few interesting studies are presented to give some flavor of this empirical work.⁷ The second goal is to formulate a few thoughts on how to deal with and interpret these empirical results. The message of this paper in that respect is that, in order to provide such interpretation, one obviously needs some theoretical backing as well.

The remainder of this contribution is structured as follows: first, a few general studies on what determines environmental quality and on the question of whether industry is really affected by the stringency of environmental law will be presented; next, a few studies related to particular environmental policy instruments, including liability rules, regulation and market-based instruments are discussed. Then, the paper turns to the enforcement of environmental law and concludes by addressing a few opportunities and challenges posed by the empirical research.

I. LAW AND ENVIRONMENTAL QUALITY

Starting at a very general level, it may be interesting to point at important economic studies that, on the one hand address the question of to what extent environmental law plays a role in determining environmental quality, and on the other hand address the question of to what extent environmental regulation influences decisions of firms. This type

⁶ The prerequisites for doing decent empirical analysis are indeed not that easy to meet. For details, see Ben C.J. van Velthoven, *Empirics of Tort*, in *TORT LAW AND ECONOMICS* 453, 454–55 (Michael Faure ed., 2009).

⁷ Most environmental policy overviews that do discuss empirical work focus on the results of U.S.-based empirical research. See, e.g., Revesz & Stavins, *supra* note 3. Meanwhile, interesting studies have also been published concerning the experience in Europe and in some developing countries. See, e.g., Shen, *supra* note 4 (discussing China); *infra* note 79 and accompanying text (discussing the European Union). This Article contributes to earlier literature by discussing these European and developing country experiences as well.

of research provides interesting insight into the relative importance of institutions like environmental law, but also on the general ability to steer the behavior of industry.

A. *What Determines Environmental Quality?*

Highly interesting empirical research has been undertaken using the concept of the “Environmental Kuznets Curve.”⁸ This concept, named after the Nobel Prize winner Simon Kuznets,⁹ examines the relationship between income inequality and income level in a country.¹⁰ Various scholars have shown empirically that in a first phase of the Kuznets Curve, economic development leads to environmental degradation.¹¹ However, there is a certain turning point in economic development, logically related to the point where individual income levels increase and a demand for higher environmental quality emerges, where increased economic welfare goes hand in hand with environmental improvements.¹² The interesting question is, of course, when a nation reaches that turning point and, for example in China’s case, whether China has already reached the point where a demand for environmental protection emerges.

This work is strongly related to the work of Michael Porter, holding that environmental improvement does not necessarily come at the expense of competitiveness. To the contrary, increased environmental performance leads to the increased competitiveness of nations and industries.¹³ This so-called “Porter Hypothesis” has been tested in many studies, most of which provide empirical support for the existence of a so-called Environmental Kuznets Curve.¹⁴ Existing empirical studies look at the relationship between per capita income and various environmental indicators, and indeed

⁸ See Edward B. Barbier, *Introduction to the Environmental Kuznets Curve Special Issue*, ENV’T & DEV. ECON. 369, 369–70 (1997).

⁹ *The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 1971: Simon Kuznets*, THE NOBEL FOUNDATION, http://www.nobelprize.org/nobel_prizes/economics/laureates/1971/ (last visited Jan. 31, 2012).

¹⁰ See Simon Kuznets, *Economic Growth and Income Inequality*, 45 AM. ECON. REV. 1, 1–2 (1955) (outlining the Kuznets Curve theory).

¹¹ See, e.g., Barbier, *supra* note 8; Thomas M. Selden & Daqing Song, *Neoclassical Growth, the J Curve for Abatement, and the Inverted U Curve for Pollution*, 29 J. ENVTL. ECON. & MGMT. 162, 162 (1995).

¹² See Barbier, *supra* note 8, at 377, 379–80.

¹³ Michael E. Porter & Claas van der Linde, *Toward a New Conception of the Environment—Competitiveness Relationship*, 9 J. ECON. PERSP. 97, 97–98 (1995).

¹⁴ For more, particularly the contributions to the special issue of environment and development economics devoted to the environmental Kuznets Curve, see Barbier, *supra* note 8, at 372–75, 379.

show roughly that while environmental pollution is first rising as income increases, after a turning point, pollution levels begin to fall.¹⁵ Interestingly, recent empirical studies show similar evidence for China; comparing the scale of economic activity and environmental quality with a broad set of environmental indicators between Chinese provinces.¹⁶

The policy conclusion from these studies seems to be that the best way for a nation such as China to promote environmental protection is to promote economic growth. Empirical evidence, after all, shows that higher income levels go hand in hand with increased environmental protection.¹⁷ This leads, at first blush, to the conclusion that environmental law can only, to a limited extent, influence environmental quality, since it is to a large extent dependent upon other factors such as economic welfare and income levels.

However, at this point, one should also take into account a related type of important research in economics which explains the economic success of particular nations. An important lesson from this empirical literature, strongly represented by four economists—La Porta, Lopez-de-Silanes, Shleifer, and Vishny—is that institutional, and more particularly legal, rules are the most important determinates of economic growth.¹⁸

Dan Esty and Michael Porter examined empirically to what extent not only income levels, as suggested by the Environmental Kuznets Curve literature, but also a nation's regulatory regime influences environmental quality.¹⁹ The results of this powerful research, based on an examination of regulatory intensity and environmental quality in a great number of

¹⁵ See, e.g., Selden & Song, *supra* note 11, at 162–63.

¹⁶ See Shen & Hashimoto, *supra* note 4.

¹⁷ See, e.g., Daniel C. Esty & Michael E. Porter, *Industrial Ecology and Competitiveness*, 2 J. INDUS. ECOLOGY 35, 36–37 (1998) (explaining that companies can be more profitable even if they make more expensive products, since consumers will see added environmental benefit as a value worth spending more on); Daniel C. Esty & Michael E. Porter, *Measuring National Environmental Performance and its Determinants*, in THE GLOBAL COMPETITIVENESS REPORT 60, 60–61, 73 & fig.7 (Michael E. Porter & J. Sachs eds., 2000).

¹⁸ See Rafael La Porta et al., *The Economic Consequences of Legal Origins*, 46 J. ECON. LITERATURE 285, 286, 326 (2008); Rafael La Porta, Florencio Lopez-de-Silanes, Andrei Shleifer & Robert W. Vishny, *Law and Finance*, 106 J. POL. ECON. 1113, 1114, 1152 (1998). This builds further on the important research of Nobel Prize winner Douglass North on the importance of institutions in economic growth. See DOUGLASS C. NORTH, *STRUCTURE AND CHANGE IN ECONOMIC HISTORY* ix (1981); DOUGLASS C. NORTH, *INSTITUTIONS, INSTITUTIONAL CHANGE AND ECONOMIC PERFORMANCE* 3 (1990).

¹⁹ See Daniel C. Esty & Michael E. Porter, *National Environmental Performance: An Empirical Analysis of Policy Results and Determinants*, 10 ENV'T & DEV. ECON. 391, 393 (2005).

developed and developing countries, is that economic development and environmental protection go hand in hand with the improvement of a country's institutions, and more particularly the environmental regulatory regime.²⁰ The empirical evidence hence suggests that a country can benefit environmentally not only from economic growth, but also from developing the rule of law and strengthening its governance structures.²¹ Interestingly, they also found evidence that countries that adopted "a stringent environmental regime relative to their income" were able to "speed up economic growth rather than retard[ing] it."²²

An important policy conclusion from this empirical literature is since the Environmental Kuznets Curve indicates a relationship between economic growth and higher environmental quality, not that environmental law does not matter.²³ To the contrary, Esty and Porter's research could show convincingly that strengthening the regulatory structure also encourages the promotion of environmental quality.²⁴ Moreover, the evidence presented by Esty and Porter provides yet another confirmation of the so-called "Porter Hypothesis": countries adopting a stringent environmental regime should not be afraid that this endangers their competitive position, since the evidence shows that this may speed up economic growth rather than retard it.²⁵

B. *Environmental Regulation and Mobility*

Another strand of empirical literature that provides general insights on the influence of environmental regulation is the so-called "race-to-the-bottom" or "pollution haven" literature. This literature examines to what extent differences in environmental regulation affect firms to such an extent that they would decide to take cost differences into account when making a decision on where to locate their firm or to relocate to so-called pollution havens.²⁶

²⁰ See *id.* at 391, 393.

²¹ *Id.* at 424.

²² *Id.* at 425.

²³ See Barbier, *supra* note 8, at 369–70.

²⁴ See Seth Binder & Eric Neumayer, *Environmental Pressure Group Strength and Air Pollution: An Empirical Analysis*, 55 *ECOLOGICAL ECON.* 527, 528 (2005).

²⁵ See Esty & Porter, *National Environmental Performance*, *supra* note 19, at 425.

²⁶ For a summary of the literature, see Michael G. Faure & Jason Scott Johnston, *The Law and Economics of Environmental Federalism: Europe and the United States Compared*, 27 *VA. ENVTL. L.J.* 205, 244 (2009).

For quite some time, empirical evidence for such a race-to-the-bottom was rather weak. For example, Repetto held in 1985:

The idea that a company will move its production—a step that involves selling its plant, severing its workforce, persuading key personnel to relocate, acquiring a new site, building a new facility, recruiting and training new workers, and undergoing a shakedown period for a new plant—only to save pollution control costs totaling less than 2 percent of sales absolutely strains credulity. When companies move their plants, other forces are at work.²⁷

The same line of reasoning was followed in a paper by Jaffe and others who summarized the empirical literature as finding that the effects of environmental regulations were “either small, statistically insignificant, or not robust to tests of model specification.”²⁸ They suggested that the stringency of environmental regulations might have some effect on new firms in their decision to locate for the first time, but that differences would not induce existing firms to relocate.²⁹ They argued that other criteria such as tax levels, public service levels, and the unionization of the labor force have a much more significant impact on siting decisions than environmental regulation does.³⁰

More recent work shows, however, a more balanced picture. For example, Kolstad and Xing argued that the laxity of environmental regulations in a host country is a significant determinant of foreign direct investment from the United States chemical industry.³¹ The more lax a country's regulations, the more likely the country is to attract foreign investment.³² This can also be understood: this evidence concerns a first location and not relocation and moreover, marginal cost differences with countries outside the United States may be substantial.³³

²⁷ Robert Repetto, United Nations Environment Programme, *Trade and Sustainable Development*, in ENVIRONMENT AND TRADE SERIES 22 (1986).

²⁸ Adam B. Jaffe et al., *Environmental Regulation and the Competitiveness of U.S. Manufacturing: What Does the Evidence Tell Us?*, 33 J. ECON. LITERATURE 132, 157–58 (1995).

²⁹ *Id.* at 148–50.

³⁰ *Id.* at 148–49, 158.

³¹ Yuquing Xing & Charles D. Kolstad, *Do Lax Environmental Regulations Attract Foreign Investment?*, 21 ENVTL. & RESOURCE ECON. 1, 1–3, 15 (2002).

³² *Id.* at 1–2.

³³ *See id.* at 4.

Recent work by List and others argues that being out of attainment with federal standards leads to an estimated cost for the particular area of between 0.7 and 1.3 new plants per year.³⁴ This is considered a huge loss given the fact that the average county in the sample they studied only received 0.4 new plants per year.³⁵ Also, other recent empirical work by Millimet and List shows that environmental regulation does have a statistically significant effect on industry location.³⁶

The least one can say, based on this empirical material, is that environmental regulation does matter also in decisions of industries on where to locate their activities and plants.³⁷

II. SPECIFIC INSTRUMENTS

Turning now to more specific instruments, one can address the question to what extent empirical evidence shows that these instruments do have the effects they are supposed to have based on the literature.

A. *Liability Rules*

1. Deterrent Effect of CERCLA

A first instrument, still very popular in environmental law, is the use of liability rules. They are supposed to have a preventive effect and deter potential polluters.³⁸ There is quite a bit of empirical evidence confirming that environmental liability does have a deterrent effect and indeed influences the behavior of potential polluters. For example, Alberini and Frost found that waste generators do respond to the fact that they can “be held liable for the cost of cleanup if the waste disposal site contaminates

³⁴ John A. List et al., *Effects of Environmental Regulations on Manufacturing Plant Births: Evidence from a Propensity Score Matching Estimator*, 85 REV. ECON. & STAT. 944, 948 (2003).

³⁵ *Id.*

³⁶ See, e.g., Daniel L. Millimet & John A. List, *The Case of the Missing Pollution Haven Hypothesis*, 26 J. REG. ECON. 239, 240, 253, 256 (2004) (noting the effect of compliance with federal air pollution regulations on new plant births and plant exits across the counties of New York State).

³⁷ See Faure & Johnston, *supra* note 26, at 246–48 (providing a further discussion of the empirical evidence).

³⁸ See, e.g., Monti, *supra* note 4, at 56.

the environment after closure or abandonment and thus falls under the federal or state Superfund legislation.”³⁹

A lot of research has also been devoted to the effects of the so-called superfund liability under the United States Comprehensive Environmental Response Compensation and Liability Act (“CERCLA”). Most of these studies conclude that liability creates incentives, *inter alia*, towards precaution “in managing hazardous wastes and discourag[ing] development of old industrial sites.”⁴⁰ At the same time, this research also shows that one has to be careful with interpreting the results.⁴¹ As such, the mere fact that legislative duties to pay for cleanup costs would give incentives for prevention of waste generation does not necessarily mean that the overall judgment is that superfund would be an efficient system. There is equal evidence that the administrative costs (a large part consisting of legal fees paid to the lawyers) of Superfund (especially litigation) can be spectacularly high as well.⁴² Viscusi and Hamilton also found that the cost of cleanup per case of cancer prevented to be “in an excess of \$6 billion,” whereas “the benefits of Superfund cleanup are highly concentrated at a very small percentage of sites, with most cleanup actions failing any reasonable efficiency test.”⁴³ The mere fact that liability provides incentives for prevention therefore does not necessarily imply that the system is efficient.⁴⁴

Related and equally interesting research has pointed at the success of the liability provisions in the United States Oil Pollution Act of 1990 (“OPA”). A study by the Oil Companies International Marine Forum (“OCIMF”) holds that since the entry into force of the OPA, the volume

³⁹ Anna Alberini & Shelby Frost, *Forcing Firms to Think about the Future: Economic Incentives and the Fate of Hazardous Waste*, 36 ENVTL. & RESOURCE ECON. 451, 451, 466, 468–69 (2007).

⁴⁰ E.g., Hilary Sigman, *Environmental Liability in Practice: Liability for Clean-Up of Contaminated Sites Under Superfund*, in THE LAW AND ECONOMICS OF THE ENVIRONMENT 136, 147 (Anthony Heyes ed., 2001).

⁴¹ *Id.* at 137, 147.

⁴² See Shreekant Gupta et al., *Do Benefits and Costs Matter in Environmental Regulation? An Analysis of EPA Decisions Under Superfund*, in ANALYZING SUPERFUND ECONOMICS, SCIENCE, AND LAW 83, 83, 107 (Richard L. Revesz & Richard B. Stewart eds., 1995); Shreekant Gupta et al., *Paying for Permanence: An Economic Analysis of EPA's Cleanup Decisions at Superfund Sites*, 27 RAND J. ECON. 563, 563–64, 581 (1996).

⁴³ W. Kip Viscusi & James T. Hamilton, *Are Risk Regulators Rational? Evidence from Hazardous Waste Cleanup Decisions*, 89 AM. ECON. REV. 1010, 1012, 1025 (1999).

⁴⁴ For a summary of the statistical evidence on the deterrence effect of environmental liability, see Kathleen Segerson, *An Assessment of Legal Liability as a Market-Based Instrument*, in MOVING TO MARKETS IN ENVIRONMENTAL REGULATION: LESSONS FROM TWENTY YEARS OF EXPERIENCE 250, 257, 266 (Jody Freeman & Charles D. Kolstad eds., 2007).

of oil spilled from tankers into United States waters has “fallen from an average of 70,000 barrels per year to an average of 4,000 barrels per year—a decrease of 95%.”⁴⁵ The study holds that the introduction of so-called double hulls following the introduction of OPA had no apparent impact on improved pollution performance.⁴⁶ The reduction would be largely due to the liability and compensation regime of OPA, which holds vessel owners strictly liable for costs and damages resulting from oil spills.⁴⁷ This, so the study holds, serves as a real deterrent to pollution.⁴⁸

2. Strict Liability Versus Negligence

Much research is also devoted to the question of whether environmental liability should be deterred through a negligence or a strict liability rule. Economic literature has often advanced strict liability for environmental pollution, since it provides the potential polluters optimal incentives for accident reduction.⁴⁹ Empirical research, for example, by Alberini and Austin, indeed confirmed that the imposition of strict liability in state environmental policies reduced unintended pollution releases.⁵⁰ Firms therefore show behavioral responses of avoiding liability “when they are strictly liable for releases of hazardous chemicals into the environment.”⁵¹

However, the same authors also found the remarkable result that in states with strict liability, a greater spill severity and frequency could be found, which was associated with smaller production units and thus reduced assets, whereas this phenomenon was not found in states following negligence-based liability.⁵² At first sight, this surprising result (more severe pollution cases under strict liability than under negligence) seems to deny the assumption of the literature that strict liability would provide

⁴⁵ OIL COS. INT’L MARINE FORUM, THE U.S. OIL POLLUTION ACT OF 1990 (‘OPA 90’): WHY HAS IT BEEN SO SUCCESSFUL AT REDUCING SPILLS? 1 (2003).

⁴⁶ *Id.*

⁴⁷ *See, e.g.*, Charles M. Davis, MARITIME LAW DESKBOOK 373–75 (2010) (“Liability for cleanup costs and damages under the Oil Pollution Act is without regard to negligence, and the only defenses are that the discharge was caused *solely* by an act of God, act of war, negligence on the part of the United States Government, or an act or omission of a third party.”).

⁴⁸ OIL COS. INT’L MARINE FORUM, *supra* note 45.

⁴⁹ *See, e.g.*, Steven Shavell, *Strict Liability Versus Negligence*, 9 J. LEGAL STUD. 1, 2–3 (1980). *But see, e.g.*, Barbara Pozzo, *The Liability Problem in Modern Environmental Statutes*, 4 EUR. REV. PRIVATE L. 111 (1996).

⁵⁰ *See* Anna Alberini & David Austin, *Liability Policy and Toxic Pollution Releases*, in THE LAW AND ECONOMICS OF THE ENVIRONMENT 92, 112 (Anthony Heyes ed., 2001).

⁵¹ *Id.*

⁵² *Id.*

better incentives for prevention. However, the same economic literature has equally indicated that strict liability could indeed lead to perverse results if polluters were potentially insolvent, meaning that the losses could be higher than their assets.⁵³ The fact that Alberini and Austin hence found that, under strict liability, firms organize themselves in smaller production units with reduced assets precisely confirms the assumption in the literature that strict liability is efficient only if a remedy for the insolvency problem can be found. The normative conclusion from this empirical research is hence not that the policy maker should not introduce strict liability for environmental pollution, but rather that if a serious insolvency risk exists, the introduction of strict liability should be accompanied with solvency guarantees, such as the introduction of compulsory insurance.⁵⁴ Otherwise, strict liability may exactly have the effect of driving polluters to reduce the assets that are exposed to liability.⁵⁵

3. Increased Liability and Liability Avoidance

An interesting effect of environmental liability was discovered in empirical research as a result of the enlargement of the European Union to Eastern Europe. Potential buyers of property in Central and Eastern Europe could be held liable, also retrospectively, for cleaning up sites that were contaminated in the past.⁵⁶ Not surprisingly, research showed that this retrospective liability seriously limited the possibilities for privatization in those countries, since potential investors were scared away by the foresight of having to pay for the pollution of the past.⁵⁷ Other research also confirmed that limited information to investors regarding the extent of past environmental contamination (and the related cleanup costs) also reduced the investors' willingness to pay for a particular enterprise in a bid.⁵⁸

⁵³ See S. Shavell, *The Judgment-Proof Problem*, 6 INT'L REV. L. & ECON. 45, 45 (1986). See generally Robert Cooter, *Prices and Sanctions*, 84 COLUM. L. REV. 1343, 1343–523 (1984).

⁵⁴ See, e.g., Peter-J. Jost, *Limited Liability and the Requirement to Purchase Insurance*, 16 INT'L REV. L. & ECON. 259, 259–60 (1996); Mattias K. Polborn, *Mandatory Insurance and the Judgment-Proof Problem*, 18 INT'L REV. L. & ECON. 141, 141–43 (1998).

⁵⁵ For an overview of the literature concerning the incentive impacts of environmental liability, see Dietrich Earnhart, *Liability for Past Environmental Contamination and Privatization*, 29 ENVTL. & RESOURCE ECON. 97, 100–01 (2004).

⁵⁶ Randall A. Bluffstone & Theodore Panayotou, *Environmental Liability and Privatization in Central and Eastern Europe: Toward an Optimal Policy*, 17 ENVTL. & RESOURCE ECON. 335, 335–37 (2000).

⁵⁷ *Id.* at 336.

⁵⁸ Earnhart, *supra* note 55, at 97–99, 104.

Specific empirical research has also been devoted to the compensation mechanisms after an oil spill. Hendrickx shows that “[c]lean-up operations have become more expensive,” particularly as a result of pressure from environmental groups and public opinion.⁵⁹ However, he equally found that, “[f]or a higher proportion of spills, the polluter cannot be identified.”⁶⁰ He suspects that, as a result of the stricter liability of the tanker owner, they “might have improved their skill of concealing their identity.”⁶¹

This again shows the straightforward point that imposing stricter liabilities upon polluters unavoidably comes at a price: the stricter the liability, the more polluters may have incentives to avoid liability, for example, by avoiding detection or by organizing their insolvency by bringing their polluting activities into smaller business units.⁶² These potentially perverse effects should hence be taken into account at the policy level as well.

B. Regulation

1. Theoretical Superiority of Regulation . . .

An impressive amount of literature is devoted to the effectiveness of environmental regulation. Thereby attention is paid to the question under what conditions the so-called command and control regulation may or may not be more effective than so-called economic or market-based instruments.⁶³ The theoretical starting point for regulation is a classic paper by Shavell indicating that information on optimal abatement techniques may often be better with government and, since, as mentioned before, insolvency problems can arise and for a number of reasons, a liability suit for environmental damage can never be brought;⁶⁴ regulation

⁵⁹ See Ruud Hendrickx, *Maritime Oil Pollution: An Empirical Analysis*, in *SHIFTS IN COMPENSATION FOR ENVIRONMENTAL DAMAGE* 243, 257 (Michael Faure & Albert Verheij eds., 2007).

⁶⁰ *Id.*

⁶¹ *Id.*

⁶² See Segerson, *supra* note 44, at 265 (reporting also that in strict-liability states, smaller firms have a greater propensity to spill, thus suggesting that small firms may be more likely to undertake hazardous operations).

⁶³ See generally Jason Scott Johnston, *Tradable Pollution Permits and the Regulatory Game*, in *MOVING TO MARKETS IN ENVIRONMENTAL REGULATION: LESSONS FROM 20 YEARS OF EXPERIENCE* 353 (Jody Freeman & Charles Kolstad eds., 2007); Johnston, *On the Market for Ecosystem Control*, *supra* note 4.

⁶⁴ For example, because the damage can be widespread, victims can believe damage has natural causes, victims cannot be identified, and long latency periods and problems of

may be more effective to control environmental pollution than private law instruments like liability rules.⁶⁵

2. . . . Confirmed in Empirical Studies

There seems to be substantial empirical evidence of this relative effectiveness of safety regulation in controlling environmental harm. More particularly, Dewees demonstrated in various studies that in North America the quality of the environment has improved substantially as a result of regulatory efforts, and not so much in response to legal action in tort.⁶⁶ Dewees, Duff, and Trebilcock held that the large regulatory efforts to improve the environment have been met with considerable success when measured by the reduction of emissions.⁶⁷ However, they equally stressed that while environmental regulation is a determining factor in pollutant emissions and ambient concentrations, other non-regulatory factors, such as economic growth and even the weather, also influence environmental quality.⁶⁸ The fact that economic growth strongly correlates with environmental quality of course corresponds with the literature on the Environmental Kuznets Curve, discussed above.⁶⁹

Much research is also devoted to the so-called Porter Hypothesis discussed above, holding that a better environmental performance will lead to an improvement in the efficiency of the firm and therefore to higher profits.⁷⁰ Some scholars are critical of this hypothesis, arguing

causation may exist. See Steven Shavell, *Liability for Harm Versus Regulation of Safety*, 13 J. LEGAL STUD. 357, 363, 370 (1984).

⁶⁵ See *id.* at 368–71. See generally Donald A. Wittman, *Prior Regulation Versus Post Liability: The Choice Between Input and Output Monitoring*, 6 J. LEGAL STUD. 193 (1977) (analyzing the choice between using legal as opposed to market solutions to policy problems by reference to input and output monitoring procedure); Steven Shavell, *A Model of the Optimal Use of Liability and Safety Regulation*, 15 RAND J. ECON. 271 (1984) (building further on Wittman's work and discussing the factors involved in determining which alternative should be preferred in a given situation).

⁶⁶ See Donald Dewees, *Tort Law and the Deterrence of Environmental Pollution*, in INNOVATION IN ENVIRONMENTAL POLICY 139, 158–63 (T. H. Tietenberg ed., 1992); Donald N. Dewees, *The Comparative Efficacy of Tort Law and Regulation for Environmental Protection*, 17 GENEVA PAPERS ON RISK AND INSURANCE 446, 463–64 (1992).

⁶⁷ DON DEWEES ET AL., *EXPLORING THE DOMAIN OF ACCIDENT LAW: TAKING THE FACTS SERIOUSLY* 315 (1996).

⁶⁸ *Id.* at 307.

⁶⁹ See *supra* Part I.A.

⁷⁰ See Michael E. Porter, *America's Green Strategy*, 264 SCI. AM. 168, 168 (1991); Porter & van der Linde, *supra* note 13, at 98.

that there is indeed evidence on beneficial effects of environmental performance on economic performance, but that this Porter Hypothesis only works if very specific conditions are met, related *inter alia*, to the type of policy involved, “the costs of potential innovation projects and their effect on productivity and abatement costs.”⁷¹

Among the many papers dealing with the effectiveness of various types of environmental regulations, an interesting one worth mentioning showed that industry will not adopt cleaner technologies if the regulator announces a policy which is based on best available technologies (“BAT”).⁷² If, on the other hand, the regulator announces a regulation and sticks to it, irrespective of the technology adopted by the firms, this so-called “commitment policy not only leads to positive investments in research and development, but is also welfare-improving.”⁷³

3. Influence of Interest Groups

An impressive amount of research is also devoted to the fact that, notwithstanding the beneficial effects of regulation, regulation always entails the danger that it may not be welfare improving, but rather may serve the interests of particular groups in society. The application of this so-called interest group theory of regulation has been strongly advanced by the Public Choice school.⁷⁴ Maloney and McCormick were probably the first to show that with environmental regulation, industry will try to change the contents of the regulation to its advantage.⁷⁵ They argue that industry, realizing that environmental regulation is unavoidable, will cooperate with the development of the regulation and try to change the

⁷¹ See, e.g., Armin Schmutzler, *Environmental Regulations and Managerial Myopia*, 18 ENVTL. & RESOURCE ECON. 87, 87–89, 97–98 (2001); Kjetil Telle, “*It Pays to Be Green*”—A Premature Conclusion?, 35 ENVTL. & RESOURCE ECON. 195, 195, 197–98, 215 (2006).

⁷² See Sangeeta Bansal & Shubhashis Gangopadhyay, *Incentives for Technological Development: BAT is Bad*, 30 ENVTL. & RESOURCE ECON. 345, 360 (2005).

⁷³ *Id.* at 345–46, 358–59.

⁷⁴ See generally Jane S. Shaw, *Public Choice Theory*, LIBR. OF ECON. & LIBERTY (2002), available at <http://www.econlib.org/library/Enc1/PublicChoiceTheory.html> (discussing Public Choice Theory, which models the way that interest groups affect collective decision-making, and noting that congressional representatives from northern industrial states used the 1977 Clean Air Act amendments to reduce competition).

⁷⁵ Michael T. Maloney & Robert E. McCormick, *A Positive Theory of Environmental Quality Regulation*, 25 J.L. & ECON. 99, 108 (1982).

contents to its advantage.⁷⁶ A classic example is the introduction of so-called “grandfather clauses,” which stipulate that the regulation will not be applicable to firms or products which are already active on the market.⁷⁷ Nash and Revesz showed that new regulations with grandfather clauses will retard the introduction of new, clean plants and will keep inefficient plants operating longer than they otherwise would.⁷⁸ There is, of course, also ample evidence that the grandfathering of emission rights under the European Emission Trading Scheme seriously reduced incentives of industry for pollution abatement.⁷⁹

Also, as far as China is concerned, there is empirical evidence that environmental regulation does not always follow the road to optimality. Da Zhu and Jiang Ru showed that the Environmental Impact Assessment Law of 2003 lacked effective implementation in China basically because non-environmental ministries evaded the Act or organized planning environmental assessments on their own without participation by the State Environmental Protection Administration (“SEPA”).⁸⁰ In China’s case it was bureaucratic politics and rising tensions between various ministries that prevented the implementation of efficient environmental regulation, in this case related to environmental impact assessment.⁸¹

Public Choice Theory also predicts that if it were possible to organize a countervailing power against industry lobbying, a kind of competition between various pressure groups could emerge, the result of which may be closer to the optimum than when government is only lobbied by

⁷⁶ *Id.*

⁷⁷ *See id.* at 101 (utilizing the Clean Air Act as an example of such “deferential pollution-control requirements”).

⁷⁸ Jonathan Remy Nash & Richard L. Revesz, *Grandfathering and Environmental Regulation: The Law and Economics of New Source Review* 28–30 (N.Y.U. Sch. of Law, Pub. Law & Legal Theory Research Paper Series, Working Paper No. 07-03, 2007), available at <http://ssrn.com/abstract=965840>.

⁷⁹ Alfred Endres & Cornelia Ohl, *Kyoto, Europe?—An Economic Evaluation of the European Emission Trading Directive*, 19 EUR. J.L. & ECON. 17, 28 (2005); *see also* Brigitte Egelund Olsen, *The IPPC Permit and the Greenhouse Gas Permit*, in EU CLIMATE CHANGE POLICY: THE CHALLENGE OF NEW REGULATORY INITIATIVES 153 (Marjan Peeters & Kurt Deketelaere eds., 2006); Edwin Woerdman et al., *European Emissions Trading and the Polluter Pays Principle: Assessing Grandfathering and Over-Allocation*, in CLIMATE CHANGE AND EUROPEAN EMISSIONS TRADING: LESSONS FOR THEORY AND PRACTICE 128, 128–29 (Michael Faure & Marjan Peeters eds., 2008).

⁸⁰ Da Zhu & Jiang Ru, *Strategic Environmental Assessment in China: Motivations, Politics and Effectiveness*, 88 J. ENVTL. MGMT. 615, 622, 625 (2008).

⁸¹ *Id.* at 622–25.

pressure groups representing industry interest.⁸² Binder and Neumayer present some powerful empirical evidence of this for the environmental area.⁸³ They provide a systematic quantitative test of the relationship between the strength of environmental NGOs and air pollution levels.⁸⁴ They find that environmental NGOs exert a statistically significant impact on sulfur dioxide, smoke and heavy particulates concentration levels, based on a cross-country time series regression analysis.⁸⁵ This recent paper thus provides an important empirical backing for something environmental lawyers have long advocated: public participation and NGO influence will effectively help to achieve lower pollution levels.⁸⁶

C. *Command and Control Versus Market-Based Instruments*

An impressive amount of literature has dealt with the various aspects of comparing the traditional command and control approach via regulation with more incentive-based mechanisms, referred to as economic or market-based instruments.⁸⁷ One lesson from this literature is that it is impossible to compare general regulation with market-based instruments, since the superiority of the one or the other is very much dependent upon the specific context, type of pollutant regulated, institutional design, etc. It is indeed not difficult to point to research showing that a regulatory approach can lead to significant reductions of, for example, waste water emissions, and encourage the implementation of less polluting production techniques in the long run.⁸⁸ As long as command and control approaches are designed with at least one eye on cost savings, incentive based systems are not necessarily superior to command and control.⁸⁹ Therefore one

⁸² See generally Gary S. Becker, *A Theory of Competition Among Pressure Groups for Political Influence*, 98 Q. J. ECON. 371, 386, 394–95 (1983) (asserting that non-cooperative competition between pressure groups for political influence favors efficiency).

⁸³ Binder & Neumayer, *supra* note 24, at 530–31.

⁸⁴ *Id.*

⁸⁵ *Id.* at 531.

⁸⁶ *Id.* at 537.

⁸⁷ For an excellent summary, see generally Revesz & Stavins, *supra* note 3; Johnston, *supra* note 63.

⁸⁸ See Gunter Stephan, *Economic Impact of Emission Standards: A Computational Approach to Waste Water Treatment in Western Europe*, in WELFARE AND EFFICIENCY IN PUBLIC ECONOMICS 401, 403 (Dieter Bös et al. eds., 1988).

⁸⁹ See Wallace E. Oates et al., *The Net Benefits of Incentive-Based Regulation: A Case Study of Environmental Standard Setting*, 79 AM. ECON. REV. 1233, 1240 (1989).

has to be careful with too sharply distinguishing the two. After all, command and control approaches also include a wide variety of measures, some of which are quite crude, but others which produce results as efficient as economic incentives.⁹⁰ One should keep in mind that one has to be very careful with those types of comparisons. Now a few examples of success stories of market-based instruments, at least as far as reducing emissions is concerned, will be provided based on empirical literature.⁹¹ That does not, however, necessarily imply that similar results could not have been reached with a regulatory approach.⁹²

D. Taxation

1. A Few Success Stories

There is a long tradition now with using the so-called Pigovian taxes to provide incentives for emission reduction. Those interested in the details can have a look at recent literature providing detailed overviews⁹³ or can be referred to the global conferences on environmental taxation which are held on an annual basis, as a result of which impressive volumes are produced providing evidence of the successes obtained with environmental taxation.⁹⁴ Just to mention a few success stories: in the

⁹⁰ See Wallace E. Oates, *Economics, Economists and Environmental Policy*, 16 E. ECON. J. 289, 292–93 (1990). See generally Wallace E. Oates, *The Environment and the Economy: Environmental Policy at the Crossroads*, in THE ECONOMICS OF ENVIRONMENTAL REGULATION 311–45 (Wallace E. Oates ed., 1996).

⁹¹ See *infra* Part II.D.1.

⁹² For an overview of the literature, see Richard B. Stewart, *Economic Incentives for Environmental Protection: Opportunities and Obstacles*, in ENVIRONMENTAL LAW, THE ECONOMY AND SUSTAINABLE DEVELOPMENT 171, 203–18 (Richard L. Revesz et al. eds., 2000); Bruce A. Ackerman & Richard B. Stewart, *Reforming Environmental Law: The Democratic Case for Market Incentives*, 13 COLUM. J. ENVTL. L. 171, 185–86 (1988); Richard B. Stewart, *Controlling Environmental Risks Through Economic Incentives*, 13 COLUM. J. ENVTL. L. 153, 159–61 (1988).

⁹³ See, e.g., WINSTON HARRINGTON ET AL., CHOOSING ENVIRONMENTAL POLICY: COMPARING INSTRUMENTS AND OUTCOMES IN THE UNITED STATES AND EUROPE 1–22 (Winston Harrington et al. eds., 2004) (providing a comparative overview between regulatory command and control instruments and economic incentive instruments, such as taxation).

⁹⁴ For the most recent volume, containing the papers presented at the Ninth Global Conference on Environmental Taxation in Singapore in 2008, see CRITICAL ISSUES IN ENVIRONMENTAL TAXATION: INTERNATIONAL AND COMPARATIVE PERSPECTIVES (Lin-Heng Lye et al. eds., vol. VII, 2009).

Netherlands, “water pollution by 14 industries responsible for 90% of total water pollution decreased by 50% between 1969 and 1975, and by another 20% by 1980.”⁹⁵ Half of this reduction was, so the evidence shows, due to an effluent charge.⁹⁶ A similar success story comes from Germany where various scholars provided evidence that a system of charges on waste water led to a considerable reduction of emissions.⁹⁷ Interestingly, most of these European legal systems had, and still have, a combination of effluent charges with emission standards.⁹⁸ Still the evidence shows that these significant investments in water treatment plants were not only due to the threat of administrative and/or criminal sanctions in case of violation of emission standards, but also to taxation.⁹⁹ Comparative research by Bongaerts and Kraemer comparing the water pollution charges in France, the Netherlands, and Germany came to the same conclusion: that effluent charges provide a strong incentive to invest in water pollution abatement equipment.¹⁰⁰ The authors argue that the effect is especially strong in Germany where the charges are reduced by fifty percent for emitters who meet the emission standard.¹⁰¹ Also, a recent study by Morley on environmental taxation in EU member states and Norway confirms a significant negative relationship between taxes and pollution.¹⁰² That study hence confirms that the current use of environmental taxes to reduce the EU’s levels of pollution appear to be having some effects.¹⁰³

⁹⁵ See Dewees et al., *supra* note 67, at 326–27.

⁹⁶ *Id.*

⁹⁷ See Gardner M. Brown, Jr. & Ralph W. Johnson, *Pollution Control by Effluent Charges: It Works in the Federal Republic of Germany, Why Not in the U.S.*, 24 NAT. RESOURCES J. 929, 933–37, 943–45, 962–63 (1984); see also BRUNO S. FREY, *UMWELTÖKONOMIE* 149, 151 (1972).

⁹⁸ Agnieszka Laskowska & Frank Scrimgeour, *Environmental Taxation: The European Experience* 9 (Univ. of Waikato, Working Paper, 2002), available at <http://wms-soros.mngt.waikato.ac.nz/NR/exeres/E33CCD10-4841-47AE-8A1A-C66E1B01E9FD.htm>.

⁹⁹ Brown, Jr. & Johnson, *supra* note 97, at 932–33, 962.

¹⁰⁰ See, e.g., Jan C. Bongaerts & R. Andreas Kramer, *Water Pollution Charges in Three Countries: Control Through Incentives*, 1 EUR. ENV'T REV. 12, 15 (1987).

¹⁰¹ *Id.* at 15; see also Laskowaska & Scrimgeour, *supra* note 98, at 14 (arguing also that it is difficult to disentangle the separate effects of charges and emission standards and listing various taxes).

¹⁰² Bruce Morely, *Empirical Evidence on the Effectiveness of Environmental Taxes* (Univ. of Bath, Working Paper No. 02/10, 2010), available at <http://opus.bath.ac.uk/18105/1/0210.pdf>.

¹⁰³ *Id.* at 15.

2. Interest Groups Affecting Environmental Taxes

One should, however, not immediately become overly enthusiastic, since there is equal evidence that the special interest groups, of which we mentioned before, affect the quality of regulation and can also be active when it comes to designing a taxation system. It is, for example, remarkable that pollution permits are introduced on a large scale in the United States, but that taxation systems were traditionally more popular in Europe than in the United States.¹⁰⁴ Buchanan, together with Tullock, has argued that this should not come as a surprise, since firms will prefer emission standards or emission trading, especially when emission rights are grandfathered, to taxes.¹⁰⁵ Standards have the advantage that they can serve as a barrier to entry to new firms, thus raising the profits of existing firms.¹⁰⁶ Taxes on the other hand do not preclude entry by new firms and represent an additional cost to the existing firms on the market.¹⁰⁷ It should not come as a surprise that interest groups representing industry will oppose taxation, and that as a result, charges are rarely introduced "in their textbook form."¹⁰⁸ Moreover, governments often use fees as a revenue-generating device for public services rather than as an instrument of environmental policy, as predicted by economic theory.¹⁰⁹

As a result there is also a lot of evidence of inefficient environmental taxation, and not surprisingly the likelihood of these inefficiencies increases as the power of the interest group involved grows. A few examples can illustrate this.

Belgian research shows that whereas a general tax to internalize externalities created by the power-generating sector could create important welfare gains, the Belgian regulation is structured in such a way that "independent power producers escape most of the air pollution regulation" imposing the tax.¹¹⁰

¹⁰⁴ See James M. Buchanan & Gordon Tullock, *Polluters' Profits and Political Response: Direct Controls Versus Taxes*, 65 AM. ECON. REV. 139, 142 (1975).

¹⁰⁵ See *id.* at 142–46.

¹⁰⁶ See Robert W. Hahn, *Economic Prescriptions for Environmental Problems: How the Patient Followed the Doctor's Orders*, 3 J. ECON. PERSP. 95, 107 (1989).

¹⁰⁷ *Id.*

¹⁰⁸ *Id.* at 107–08.

¹⁰⁹ *Id.* at 107.

¹¹⁰ See A. Bigano et al., *Alternative Environmental Regulation Schemes for the Belgian Power Generation Sector*, 16 ENVTL. & RESOURCE ECON. 121, 149 (2000).

In the Netherlands a regulatory digressive energy tax was introduced in 1996.¹¹¹ As a result the larger the energy use was, the lower the tax would be.¹¹² This tax therefore only gives incentives to increase the use of energy rather than to decrease it. The main concern of the policy-makers was to increase competitiveness of Dutch industry rather than to serve any ecological goal.¹¹³

Similar problems arose in China. O'Connor reports on pollution charges on "air emissions, waste water discharges, noise, solid waste and radioactive wastes" introduced in China at the end of the last century.¹¹⁴ Charge rates were set slightly above average operating costs of pollution control facilities in order to provide incentives for compliance.¹¹⁵ However, in practice they were not indexed to inflation, as a result of which their real value eroded over time, resulting of course, in "weak incentive[s] for further pollution reduction."¹¹⁶ Efforts to raise the charge met, not surprisingly, "strong opposition from industry."¹¹⁷ Considerations of political acceptability may hence often limit the possibilities to introduce efficient taxation systems.¹¹⁸

Similar problems arise concerning the introduction of market-based instruments and, more particularly, pollution charges in developing countries.¹¹⁹ Some have advocated that, more particularly for developing countries, market-based instruments like taxation would be well-suited. These would, at least on paper, be perfect instruments since they could

¹¹¹ MINISTRY OF HOUSING, SPATIAL PLANNING AND THE ENVIRONMENT, THE NETHERLANDS' ENERGY TAX: QUESTIONS AND ANSWERS, 1, 2 (2004).

¹¹² Michael Faure & Stefan Ubachs, *Environmental Taxation in the Netherlands: A Dutch Treat?*, in CRITICAL ISSUES IN INTERNATIONAL ENVIRONMENTAL TAXATION: INSIGHTS AND ANALYSIS FOR ACHIEVING ENVIRONMENTAL POLICY GOALS THROUGH TAX POLICY 301, 313 (Lawrence A. Kreiser ed., 2002).

¹¹³ See *id.* at 323–24; see also Michael Faure & Stefan Ubachs, *Harmful Tax Measures and Greying of Taxation in the Netherlands: What Went Wrong?*, in CRITICAL ISSUES IN ENVIRONMENTAL TAXATION: INTERNATIONAL AND COMPARATIVE PERSPECTIVES 521, 523 (Hope Ashiabor et al. eds., vol. II, 2005).

¹¹⁴ David O'Connor, *Applying Economic Instruments in Developing Countries: From Theory to Implementation*, 4 ENV'T & DEV. ECON. 91, 96 (1998).

¹¹⁵ *Id.* at 96.

¹¹⁶ *Id.* at 96–97.

¹¹⁷ *Id.* at 97.

¹¹⁸ *Id.* at 108.

¹¹⁹ For an overview of experiences with introducing pollution charges in transition economies, mostly in Central and Eastern Europe, see CONTROLLING POLLUTION IN TRANSITION ECONOMIES: THEORIES AND METHODS (Randall Bluffstone & Bruce A. Larson eds., 1997).

be implemented at lower costs than command and control regulation.¹²⁰ However, others have argued that implementing market-based instruments is only possible in a context where a decent institutional and administrative structure is available.¹²¹ These conditions will often not be met in the case of developing countries. The empirical evidence largely seems to confirm this point: in those countries where at least some institutional structure is available, for example, to set and collect environmental taxes in the public interest, they may work effectively.¹²² If these institutional conditions are not met it may become very hard to implement pollution charges.¹²³ There is evidence that institutional inertia in the economic and political system led to a debacle of pollution charges in Russia.¹²⁴ However, in cases where a successful collection is possible and where environmental charges are combined with other instruments, including traditional standards, they can lead to an overall improvement of environmental compliance, provided there is effective enforcement. This was shown in a study by Kathuria with respect to three successful cases of reducing water pollution: Malaysia, Poland, and Colombia.¹²⁵ Kathuria argued that it was the combination of charges with other instruments that led to the overall improvement in environmental compliance.¹²⁶ A similar result was also found in a study of environmental policy instruments in eight developing countries by Jordan and others.¹²⁷ They showed

¹²⁰ Allen Blackman, *Colombia's Discharge Fee Program: Incentives for Polluters or Regulators?*, 90 J. ENVTL. MGMT. 101, 101 (2009) (quoting T. Panayotou, *Economic Instruments for Environmental Management in Developing Countries*, in PROCEEDINGS OF OECD WORKSHOP ON THE USE OF ECONOMICS FOR ENVIRONMENTAL MANAGEMENT IN DEVELOPING COUNTRIES 19 (1992)).

¹²¹ See Ruth Greenspan Bell & Clifford Russell, *Environmental Policy for Developing Countries*, ISSUES IN SCI. & TECH. 63, 64–66 (2002).

¹²² *Id.* at 69–70.

¹²³ *Id.* at 63, 70.

¹²⁴ See Patrik Söderholm, *Environmental Policy in Transition Economies: The Effectiveness of Pollution Charges* 8–13 (Center of Energy and Environmental Policy Research, Massachusetts Institute of Technology, Working Paper No. 99-006, 1999) (on file with the author). See generally Michael Kozeltsev & Anil Markandya, *Pollution Charges in Russia: The Experience of 1990–1995*, in CONTROLLING POLLUTION IN TRANSITION ECONOMIES: THEORIES AND METHODS 128 (Randall Bluffstone & Bruce A. Larson eds., 1997) (explaining the period of Russian regulation, including the difficulties in implementing economic incentives).

¹²⁵ See Vinish Kathuria, *Controlling Water Pollution in Developing and Transition Countries—Lessons from Three Successful Cases*, 78 J. ENVTL. MGMT. 405, 423 (2006).

¹²⁶ *Id.*

¹²⁷ Andrew Jordan et al., *'New' Instruments of Environmental Governance: Patterns and Pathways of Change*, 12 SPECIAL ISSUE ENVTL. POL. 1, 1–24 (2003).

that even though many countries moved to the introduction of market-based instruments, regulation still remained the dominant instrument for pollution control.¹²⁸ Also, Blackman showed in a study concerning Colombia's discharge fee program that the reason why pollution loads dropped significantly after the program was introduced was not so much because of incentives provided through the discharge fees, but rather as a result of incentives created through the program "for regulatory authorities to improve permitting, monitoring and enforcement."¹²⁹ Above, it was mentioned that although earlier research on environmental taxation in China was rather skeptical of its effectiveness, especially due to political pressure not to increase the tax rate,¹³⁰ more recent research seems to indicate that China's discharge fee programs have had a positive influence on pollution levels.¹³¹

E. Emissions Trading

1. The "Living Legend" of the U.S. SO₂ Trading Program

Whereas environmental taxes and charges on emissions were popular in Europe, emission trading started in the United States.¹³² Hence already since the 1980s there has been overwhelming American research to show the effectiveness of trading in pollution rights. Making a random selection, one can for example, refer to research by Wallace Oates from 1986 concerning the well-known United States emission trading system for air pollutants.¹³³ He reports that this trading system has made real headway in certain regions and that the system has been successful.¹³⁴ Also, Hahn and Hester claim that the trading programs concerning the

¹²⁸ *Id.* at 1, 20.

¹²⁹ Blackman, *supra* note 120, at 117.

¹³⁰ See O'Connor, *supra* note 114, at 96–97 (noting the influence of industry pressure).

¹³¹ See Hua Wong & David Wheeler, *Financial Incentives and Endogenous Enforcement in China's Pollution Levy System*, 49 J. ENVTL. ECON. & MGMT. 174, 184 n.15, 194 (2005).

¹³² Richard Conniff, *The Political History of Cap and Trade: How an Unlikely Mix of Environmentalists and Free-Market Conservatives Hammered Out the Strategy Known as Cap-and-Trade*, SMITHSONIAN (August 2009), <http://www.smithsonianmag.com/science-nature/Presence-of-Mind-Blue-Sky-Thinking.html>.

¹³³ See Wallace E. Oates, *Market Incentives for Environmental Protection: A Survey of Some Recent Developments*, in PRICES, COMPETITION AND EQUILIBRIUM 251, 252, 261–65 (Maurice Peston & Richard Quandt eds., 1986).

¹³⁴ See *id.*; see also Wallace Oates & Albert M. McGartland, *Marketable Permits for the Prevention of Environmental Deterioration*, 12 J. ENVTL. ECON. & MGMT. 207, 222 (1985).

Clean Air Act have led to considerable cost savings, albeit that the cost savings may have been less than anticipated.¹³⁵ A problem is that trading may in some cases have increased emissions, more particularly where the pollution rights that were sold were previously not being fully utilized by the owner.¹³⁶ Nevertheless, the SO₂ cap and trade program has recently again been qualified as a “living legend” of market effectiveness and “the total annual health benefits associated with the SO₂ emission reductions under the program” are estimated to be more than \$50 million per year in 2010.¹³⁷ Recently Keohane estimated the annual cost savings resulting from the trading program to be \$150 million.¹³⁸

The enthusiasm concerning the trading system in the United States Clean Air Act not only comes from its environmental effectiveness, but also from the cost-savings, at least when referring to compliance costs for industry.¹³⁹ Moreover, Ellerman also showed that the administrative costs for running the emission trading system under the Clean Air Act are significantly less compared to a traditional regulatory system.¹⁴⁰ Other American studies examining the trading programs under the Clean Air Act provide a roughly similar picture.¹⁴¹

¹³⁵ Robert W. Hahn & Gordon L. Hester, *Where Did All the Markets Go? An Analysis of EPA's Emissions Trading Program*, 6 YALE J. ON REG. 109, 151 (1989).

¹³⁶ Cf. Hoong N. Young, *An Analysis of a Global CO₂ Emissions Trading Program*, 14 J. LAND USE & ENVTL. LAW 125, 145 (1998).

¹³⁷ See Dallas Burtraw & Karen Palmer, *SO₂ Cap-and-Trade Program in the United States: A “Living Legend” of Market Effectiveness*, in CHOOSING ENVIRONMENTAL POLICY: COMPARING INSTRUMENTS AND OUTCOMES IN THE UNITED STATES AND EUROPE 41, 47 (Winston Harrington et al. eds., 2004); see also A. Denny Ellerman, *Are Cap-and-Trade Programs More Environmentally Effective than Conventional Regulation?*, in MOVING TO MARKETS IN ENVIRONMENTAL REGULATION: LESSONS FROM 20 YEARS OF EXPERIENCE 48, 50 (Jody Freeman & Charles D. Kolstad eds., 2007) (showing that the SO₂ emissions trading program caused significant reductions in emissions).

¹³⁸ Nathaniel O. Keohane, *Cost Savings from Allowance Trading in the 1990 Clean Air Act: Estimates from a Choice-Based Model*, in MOVING TO MARKETS IN ENVIRONMENTAL REGULATION: LESSONS FROM 20 YEARS OF EXPERIENCE 194, 224 (Jody Freeman & Charles D. Kolstad eds., 2007).

¹³⁹ See Burtraw & Palmer, *supra* note 137, at 59 (noting the “perceived success of the SO₂ program in reducing compliance costs” has boosted a number of similar legislative proposals).

¹⁴⁰ A. Denny Ellerman, *The US SO₂ Cap-and-Trade Programme*, in TRADABLE PERMITS: POLICY EVALUATION, DESIGN, AND REFORM 71, 92 (2004); see also A. DENNY ELLERMAN ET AL., *MARKETS FOR CLEAN AIR: THE US ACID RAIN PROGRAM* 250, 294–96 (2000).

¹⁴¹ See Jonathan Remy Nash & Richard L. Revesz, *The Design of Marketable Permit Schemes to Control Local and Regional Pollutants*, in AN INTRODUCTION TO THE LAW AND ECONOMICS OF ENVIRONMENTAL POLICY: ISSUES IN INSTITUTIONAL DESIGN 331, 333, 335

2. Effectiveness of the EU Emissions Trading Scheme?

Recently, the attention has, for obvious reasons, shifted from the United States to Europe. The reason is of course that Europe chose emission trading as the instrument to implement the Kyoto Protocol and address the challenges posed by climate change.¹⁴² Too many studies to be mentioned here have addressed the effectiveness of the EU emission trading scheme (“ETS”).¹⁴³ The case of the European ETS is an interesting one, if simply to show the difficulties in interpreting the results of empirical research. Europe chose, with Directive 2003/87 of October 13, 2003, to give emissions rights, basically for free, to existing industry as a result of so-called grandfathering.¹⁴⁴ Again, the private interest theory of regulation, mentioned above,¹⁴⁵ can explain why emission trading with grandfathering was chosen instead of an environmental tax. This should not come as a surprise since grandfathering of course serves the interests of industry better¹⁴⁶ than costly taxation measures.

Also not surprising, at least at first sight, is that grandfathering, in other words giving away allowances free of any charge, may lead to over allocation of emission rights.¹⁴⁷ As a result of this over allocation in

(Timothy Swanson ed., 2002) (discussing the design of emissions trading programs more generally); Tom Tietenberg & Nick Johnston, *Ex Post Evaluation of Tradeable Permits: Methodological Issues and Literature Review*, in *TRADABLE PERMITS: POLICY EVALUATION, DESIGN, AND REFORM* 9, 29–30, 34 (2004).

¹⁴² See Marjan Peeters, *Inspection and Market-Based Regulation Through Emissions Trading: The Striking Reliance on Self-Monitoring, Self-Reporting and Verification*, 2 *UTRECHT L. REV.* 177, 177 (2006).

¹⁴³ See generally *THE KYOTO PROTOCOL AND BEYOND: LEGAL AND POLICY CHALLENGES OF CLIMATE CHANGE* (Wybe T. Douma et al. eds., 2007).

¹⁴⁴ Directive 2003/87, Establishing a Scheme for Greenhouse Gas Emission Allowance Trading Within the Community and Amending Council Directive 96/61/EC 2002 O.J. (L 275) 32, 36 (EC); INT’L EMISSIONS TRADING ASS’N, HIGH LEVEL GROUP ON THE EMISSIONS TRADING SCHEME (2006), available at http://ec.europa.eu/enterprise/policies/sustainable-business/files/environment/hlg/docs/contribution_ieta_en.pdf.

¹⁴⁵ See *supra* Part II.B.3.

¹⁴⁶ See A. Denny Ellerman, *US Experience With Emissions Trading: Lessons For CO₂ Emissions Trading*, in *EMISSIONS TRADING FOR CLIMATE POLICY: US AND EUROPEAN PERSPECTIVES* 78, 90 (Bernd Hansjürgens ed., 2005); Thomas Sterner & Henrik Hammar, *Designing Instruments for Climate Policy*, in *EMISSIONS TRADING FOR CLIMATE POLICY: US AND EUROPEAN PERSPECTIVES* 17, 31 (Bernd Hansjürgens ed., 2005).

¹⁴⁷ See Robert Baldwin, *Regulation Lite: The Rise of Emissions Trading* 9, 11, 13, 15 (LSE Law, Society, and Economy Working Papers 3/2008).

early 2007, the price of allowances dramatically dropped below €1.¹⁴⁸ This low price for allowances obviously provides evidence of over allocation by the European member states.¹⁴⁹ However, it is more difficult to answer the question whether this necessarily makes the whole EU ETS ineffective in providing incentives for emissions reductions. At first sight one may be tempted to argue that this is the case: why would any company invest in emission abatement equipment if a ton of CO₂ emission rights could be purchased at a price below €1? Marginal costs of pollution abatement are undoubtedly higher. However, Kuik and Oosterhuis convincingly argue that the over allocation could be partly the result of investments in technological and other innovations, investments which precisely caused the emissions reductions.¹⁵⁰ They showed that the EU ETS led to an additional abatement of between 50 and 200 million tons, and equally showed that this emission trading scheme played a key role in the long-term decisions of companies to develop innovative technologies with, more particularly, a strong impact on the steel industry.¹⁵¹ Hence, the mere fact that the price of a ton of CO₂ dropped below €1 (at the beginning of 2007) does not necessarily mean that the ETS had no incentive effect on innovation and is thus ineffective. Quite the reverse may be true as well; as the demand for emissions has dropped since the introduction of the EU ETS precisely because it had the desired effect of reducing those emissions.¹⁵²

These observations are of course not meant to argue that there is no room for improvement of the EU ETS; the institutional design could certainly be improved and that has to a large extent also occurred with the promulgation of the second ETS Directive.¹⁵³ However, one apparently has to be very careful in correctly interpreting results of empirical

¹⁴⁸ See COMM. ON CLIMATE CHANGE, BUILDING A LOW-CARBON ECONOMY—THE UK'S CONTRIBUTION TO TACKLING CLIMATE CHANGE 149, 150 fig.4.2 (2008), available at <http://www.theccc.org.uk/pdf/TSO-ClimateChange.pdf>.

¹⁴⁹ See Edwind Woerdman et al., *European Emissions Trading and the Polluter-Pays Principle: Assessing Grandfathering and Over-Allocation*, in CLIMATE CHANGE AND EUROPEAN EMISSIONS TRADING: LESSONS FOR THEORY AND PRACTICE 128, 143–44 (Michael Faure & Marjan Peeters eds., 2008).

¹⁵⁰ Onno Kuik & Frans Oosterhuis, *Economic Impacts of the EU ETS: Preliminary Evidence*, in CLIMATE CHANGE AND EUROPEAN EMISSIONS TRADING: LESSONS FOR THEORY AND PRACTICE 208, 212–14, 221 (Michael Faure & Marjan Peeters eds., 2008).

¹⁵¹ *Id.* at 217, 220.

¹⁵² *See id.* at 217.

¹⁵³ *See generally* Directive 2009/29 Amending Directive 2003/87/EC so as to Improve and Extend the Greenhouse Gas Emission Allowance Trading Scheme of the Community, 2009 O.J. (L140/63) (EC).

research: the price of one ton CO₂ falling below €1 does not necessarily mean that the EU ETS is ineffective. Instead, one has to interpret this in the correct context.

F. Combinations

If there is one thing clear from some of the empirical studies discussed so far, then it is something which is also stressed in theoretical papers; namely that there is not just one optimal instrument of environmental policy. Instead the key issue is how one can find an optimal combination of various instruments to reach environmental goals at the lowest cost. The strengths and weaknesses of particular institutional features of a particular legal system may play a large role in that respect. Generally, this is a point strongly made in the work by Gunningham and Grabosky,¹⁵⁴ but recent empirical research with respect to Belgium has also showed that the relative cost efficiency of various instruments (emission taxes, emission standards and technology standards) also needs to be compared with the information, monitoring, and costs of enforcement instruments (criminal fines, administrative fines, civil sanctions) to find an optimal combination of various instruments.¹⁵⁵

The empirical literature on market-based instruments has also clearly shown that it is rare that market-based instruments alone lead to improved environmental quality.¹⁵⁶ Usually, this was the case when the economic instruments were still used in combination with more traditional command and control instruments.¹⁵⁷ An important argument to support this combined use of traditional command and control with modern economic instruments can also be found in the arguments presented by Bruno Frey, who argues that economic instruments have the disadvantage that they could lead to a so-called “crowding out” of environmental morale: by simply paying for an emission right or an environmental

¹⁵⁴ NEIL GUNNINGHAM & PETER GRABOSKY, *SMART REGULATION: DESIGNING ENVIRONMENTAL POLICY* 449 (1998).

¹⁵⁵ See Sandra Rousseau & Stef Proost, *Comparing Environmental Policy Instruments in the Presence of Imperfect Compliance—A Case Study*, 32 ENVTL. & RESOURCE ECON. 337, 346, 359–61 (2005).

¹⁵⁶ GUNNINGHAM & GRABOSKY, *supra* note 154, at 14–15, 16, 83–84.

¹⁵⁷ See *id.* (noting that many have come to the conclusion that dissatisfaction with prevailing deregulation alternatives has spawned widespread recognition for the need to design optimal policy mixes combining market and traditional approaches).

tax the spontaneous willingness of industry to act environmentally consciously could be “crowded out,” or in other words, reduced.¹⁵⁸ Recently, Goeschl and Perino found evidence that taxes for CO₂ emissions crowd out intrinsic motivations, whereas emission standards are neutral.¹⁵⁹ For that reason it may be important to combine market-based instruments with traditional regulatory instruments where this “crowding out” may be less of a risk.

However, the desirability of combining different instruments should also be addressed with caution. Langpap and Shimshack recently showed that the conventional wisdom that private citizen suits would encourage public monitoring and public enforcement is not always correct.¹⁶⁰ Their empirical evidence shows that to the contrary, public and private enforcement function in practice often act as substitutes rather than as compliments.¹⁶¹ The net deterrence effects of private enforcement are, so they argue, approximately twenty-five percent lower due to so-called “crowding out” effects: the fact that effective private intervention exists apparently leads public agencies to think that scarce monitoring and enforcement resources no longer need to be devoted to public enforcement, hence reducing the overall effectiveness of environmental enforcement.¹⁶²

III. ENFORCEMENT

No matter what type of instrument is chosen in environmental policy, either command and control or market-based instruments, one always needs an effective enforcement and sanctioning system.¹⁶³ Traditional economic analysis is based on the deterrence hypothesis, as developed in

¹⁵⁸ See BRUNO S. FREY, NOT JUST FOR THE MONEY: AN ECONOMIC THEORY OF PERSONAL MOTIVATION 56–57, 64 (1997); Bruno S. Frey, *Morality and Rationality in Environmental Policy*, 22 J. CONSUMER POL'Y 395, 400, 405, 408 (1999).

¹⁵⁹ See Timo Goeschl & Grischa Perino, *Instrument Choice and Motivation: Evidence from a Climate Change Experiment* 17 (Jan. 14, 2009) (unpublished manuscript), available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1658360.

¹⁶⁰ Christian Langpap & Jay P. Shimshack, *Private Citizen Suits and Public Enforcement: Substitutes or Complements?*, 59 J. ENV'T ECON. & MGMT. 235, 248–49 (2010).

¹⁶¹ *Id.*

¹⁶² *See id.*

¹⁶³ On the importance of enforcement of market-based instruments (more particularly emissions trading), see Peeters, *supra* note 142, 178–79; Marjan Peeters, *Enforcement of the EU Greenhouse Gas Emissions Trading Scheme*, in EU CLIMATE CHANGE POLICY: THE CHALLENGE OF NEW REGULATORY INITIATIVES 169, 171 (Marjan Peeters & Kurt Deketelaere eds., 2006).

the seminal work of Gary Becker.¹⁶⁴ The starting point of this literature is that a potential polluter will make a rational calculus of costs and benefits of complying with environmental regulation and will only comply when the expected costs of a violation are higher than the potential gains.¹⁶⁵ It is well-known that violating environmental regulations, for example not installing a water treatment plant or simply delaying such an investment, can generate substantial gains. In order to deter violations, a substantial expected sanction could convince the potential perpetrator to follow the law. This expected sanction consists on the one hand of the probability of being inspected, prosecuted, and sanctioned, and on the other hand of the sanction being imposed. What does the empirical evidence teach us about these expected sanctions?

A. *Expected Sanctions for Environmental Crime*

1. Low Expected Sanctions

Data on detection and prosecution of environmental crime show that in fact the likelihood that a violation ends up in court and is sanctioned is extremely low. For the Flemish region in Belgium, based on data of the environmental inspectorate, it was found that the average probability of being apprehended and prosecuted for a violation is less than one percent, meaning that only one in one hundred firms that are in violation will be detected and prosecuted.¹⁶⁶ This not only follows from the fact that the probability to be inspected is very low,¹⁶⁷ but especially from the fact that many detected violations are not prosecuted. In the Flemish region, the prosecutor dismissed sixty-two percent of violations established by the environmental inspectorate.¹⁶⁸ Similar data comes from

¹⁶⁴ Gary S. Becker, *Crime and Punishment: An Economic Approach*, 76 J. OF POL. ECON. 169, 170, 207 (1968). For an application of Becker's crime theory to environmental crime, see Jeremy Firestone, *Enforcement of Pollution Laws and Regulations: An Analysis of Forum Choice*, 27 HARV. ENVTL. L. REV. 105, 122, 129, 132 (2003).

¹⁶⁵ See e.g., Firestone, *supra* note 164, at 128.

¹⁶⁶ Katarina Svatikova, *Economic Criteria for Criminalization: Optimizing Enforcement in Case of Environmental Violations* 115 (Mar. 14, 2011) (doctoral thesis), available at <http://repub.eur.nl/res/org/9747/> (then search "Economic criteria for criminalization: Optimizing Enforcement in Case of Environmental Violations" and follow hyperlink).

¹⁶⁷ Carole Billiet & Sandra Rousseau, *De zachte rechtshandhaving in het bestuurlijke handhavingsspoor: de inspectiebeslissing en het voortraject van bestuurlijke sancties. Een rechtseconomische analyse*, TIJDSCHRIFT VOOR MILIEURECHT 5 (2005).

¹⁶⁸ Michael G. Faure & Katarina Svatikova, *Enforcement of Environmental Law in the Flemish Region*, 19 EUR. ENERGY & ENVTL. L. REV. 60, 73 (2010).

the United Kingdom where on average the prosecution rate for pollution incidents is less than five percent.¹⁶⁹ However, serious incidents have a much higher prosecution rate.¹⁷⁰ Similar data comes from Germany, where older studies indicated that around fifty percent of all environmental violations were dismissed by the public prosecutor.¹⁷¹

Similar data can be presented as far as the sanctions that are imposed are concerned, if the case gets to the court at all. A study on the fines imposed by the courts within the competence of the Court of Appeals of Ghent in the Flemish region in the period 1990–2000 found that an average fine of €5000 was imposed both in the first instance and on appeal.¹⁷² A later study referred to average fines imposed for violations in the textile sector of €2869 in first instance and €7165 on appeal.¹⁷³ For the Netherlands, average fines imposed through the criminal system were reported ranging from €1351 to €2342.¹⁷⁴

If one looks at these average fines imposed by criminal courts in Western Europe and multiplies this with the probability of being detected and prosecuted of about one percent this would lead to estimations in expected sanctions for the Flemish region varying from €87.70¹⁷⁵ to €176¹⁷⁶ to €181.¹⁷⁷

The European experience, with low expected sanctions for environmental crime would, at first blush, be different in the United States,

¹⁶⁹ See STUART BELL & DONALD MCGILLIVRAY, ENVIRONMENTAL LAW 295–96 (6th ed. 2006).

¹⁷⁰ Svatikova, *supra* note 166, at 123.

¹⁷¹ See Volker Meinberg, *Empirische Erkenntnisse um Vollzug des Umweltstrafrechts*, 100 ZEITSCHRIFT FÜR DIE GESAMTE STRAFRECHTSWISSENSCHAFT 112 (1988); Wolfram Lutterer & Hans J. Hoch, RECHTLICHE STEUERUNG IM UMWELTBEREICH. FUNKTIONSSTRUKTUREN DES UMWELTSTRAFRECHTS UND DES UMWELTORDNUNGSWIDRIGKEITENRECHTS. EMPIRISCHE UNTERSUCHUNGEN ZUR IMPLEMENTATION STRAFBEWEHRTER VORSCHRIFTEN IM BEREICH DES UMWELTSCHUTES (Max Planck Inst. for Foreign & Int'l Crim. Law 1997).

¹⁷² Carole Billiet & Sandra Rousseau, *De hoogte van strafrechtelijke boetes. Een rechtseconomische analyse van milieurechtspraak (1990–2000) van het Hof van Beroep te Gent*, 2 TIJDSCHRIFT VOOR MILIEURECHT 120, 131 (2003).

¹⁷³ *Id.* at 131.

¹⁷⁴ See G.K. SCHOEP & P.M. SCHUYT, FEITEN EN PERCEPTIES VAN DE SANCTIOUNERING VAN MILIEUDELICTEN EN DELICTEN BETREFFENDE DE VOLKSGEZONDHEID (Universiteit Leiden 2008).

¹⁷⁵ Sandra Rousseau, *Economic Empirical Analysis of Sanctions for Environmental Violations: A Literature Overview* 9 (Energy, Transp. and Env'tl. Working Papers Series, Katholieke Universiteit Leuven, Ctr. for Econ. Studies, Working Paper No. 2007-03).

¹⁷⁶ Sandra Rousseau, *The Impact of Sanctions and Inspections on Firms' Environmental Compliance Decisions* 10 (Katholieke Universiteit Leuven, Ctr. for Econ. Studies, Working Paper No. 2007-04).

¹⁷⁷ Sandra Rousseau, *Evidence of a Filtered Approach to Environmental Monitoring*, 29 EUR. J.L. & ECON. 195, 203 (2010).

where strict sentencing guidelines apply, to which the judge should, in principle, adhere.¹⁷⁸ The fines imposed for environmental crime indeed seem on average to be higher in the United States, compared to the low amounts in Europe.¹⁷⁹ However, Barrett found in a study on the application of sentencing guidelines for environmental crime that “the sentences imposed in the majority of these cases reflected the reluctance of judges to impose significant incarceration for violations of environmental laws.”¹⁸⁰ Others even held that these sentencing guidelines led to negative outcomes for deterrence.¹⁸¹ Since judges consider the guidelines unreasonable, this results in the opposite effect of lenient sentencing of environmental criminals.¹⁸² According to some American scholars, significant violations are now in fact sentenced too leniently, which may undermine the deterrent value of environmental enforcement and may trivialize environmental law itself.¹⁸³

2. Low Deterrence?

Given these low numbers of prosecutions and sanctions, and hence correspondingly low expected sanctions, one could even ask the question why firms comply at all with environmental regulations, since at first sight a violation seems always more profitable. This phenomenon has been referred to in the literature as the Harrington Paradox, following research by Winston Harrington, who established that given low expected sanctions one would expect more environmental criminality than can be observed in practice.¹⁸⁴ However, here again one should come back to a general warning that one always has to interpret numbers with caution. Indeed, there

¹⁷⁸ For an economic critique of these sentencing guidelines, see generally Frank H. Easterbrook, *Criminal Procedure as a Market System*, 12 J. LEGAL STUD. 289 (1983).

¹⁷⁹ Several studies refer to median fines in the range of \$50,000 to \$100,000. For a summary, see Firestone, *supra* note 164, at 138–43.

¹⁸⁰ Jane J. Barrett, *Sentencing Environmental Crimes Under the United States Sentencing Guidelines—A Sentencing Lottery*, 22 ENVTL. L. 1421, 1421 (1992).

¹⁸¹ See Charles J. Babbitt et al., *Discretion and Criminalization of Environmental Law*, 15 DUKE ENVTL. L. & POL'Y F. 1, 62–63 (2004).

¹⁸² *Id.*

¹⁸³ *Id.*

¹⁸⁴ See Jon D. Harford & Winston Harrington, *A Reconsideration of Enforcement Leverage when Penalties Are Restricted*, 45 J. PUB. ECON. 391, 392 (1991). See generally Winston Harrington, *Enforcement Leverage when Penalties are Restricted: A Reconsideration Under Asymmetric Information*, 37 J. PUB. ECON. 289, 289–90 (1988) (providing a counter analysis of the phenomenon).

may well be good reasons why firms comply with environmental regulation notwithstanding the Harrington Paradox.

a. Other Sanctioning Mechanisms

One reason for compliance is that one could argue that of course not all cases are prosecuted before a criminal court, but that does not necessarily mean that nothing happens. There can in many cases also be good reasons to dismiss a case, simply because the conditions for criminal liability are not fulfilled, for example, because waste was illegally deposited but no perpetrator could be identified. Also, in cases where conditions for criminal liability are fulfilled, other mechanisms than the criminal prosecution may exist which could expose the potential polluter to expected costs.¹⁸⁵ Prosecutors can, in some legal systems, also propose a financial payment to the perpetrator and hence deal with the case themselves, in order to avoid the high administrative costs of the criminal prosecution.¹⁸⁶ This may hence add something, but probably not a lot to the expected sanction.

More powerful is probably the possibility for some environmental agencies to impose administrative fines. This exists for example in legal systems like Austria and the Netherlands that have, in addition to the criminal law, the possibility of administrative fines.¹⁸⁷ German research shows that the likelihood that these administrative fines (referred as Geldbußen) are imposed for administrative violations (referred to as Ordnungswidrigkeiten) is substantially higher than the likelihood of a prosecution in the criminal court.¹⁸⁸ Therefore, a simple conclusion is that in systems which allow administrative fines in addition to criminal prosecution one can add substantially to expected costs and thus to deterrence. The simple reason is that in those systems a dismissal in the criminal procedure does not necessarily mean that nothing happens, as an administrative fine could still be imposed, thus adding to deterrence.¹⁸⁹

¹⁸⁵ See *infra* notes 190–93 and accompanying text.

¹⁸⁶ OECD, ENSURING ENVIRONMENTAL COMPLIANCE: TRENDS AND GOOD PRACTICES 85 (2009) (using the Netherlands as an example).

¹⁸⁷ See MICHAEL G. FAURE & GUNTER HEINE, CRIMINAL ENFORCEMENT OF ENVIRONMENTAL LAW IN THE EUROPEAN UNION 21–22 (2005).

¹⁸⁸ See LUTTERER & HOCH, *supra* note 171, at 190–91.

¹⁸⁹ See Firestone, *supra* note 164, at 147–58 (discussing enforcement options available to the United States Environmental Protection Agency (“EPA”) and the enforcement choices applied to different parties). Also, in the United States, the EPA has the choice to enforce

b. Other Costs

A second point is that there may be other costs beyond the mere sanctions imposed by the courts that could deter potential violators. In that respect, one could, for example, refer to the mere fact that in cases of a criminal prosecution, the captains of industry may be confronted with the unpleasant experience of having to appear in court for several days, which can constitute a real cost (loss of time and thus opportunity costs) to them.¹⁹⁰ Moreover, the mere fact of having to appear in court, and especially being convicted by a criminal court, could lead to a “shaming” and hence to a loss of reputation for entrepreneurs.¹⁹¹ However, American empirical research by Karpoff and Lott showed that whereas the stock value of publically traded firms could fall after the announcement of a bad environmental outcome, such as an oil spill or criminal prosecution, these “stock price effects are approximately equal to government-imposed penalties, cleanup costs and private settlements.”¹⁹² It is therefore possible to conclude that a criminal conviction will not cause an additional reputational loss and that the mere fact of being labeled as a “criminal” does not lead to additional costs.¹⁹³

c. Effective Deals?

A third reason why the low prosecution rates of environmental violations in Western Europe should be interpreted with caution is that the prosecutor could in fact engage in regulatory dealings,¹⁹⁴ whereby the

environmental law administratively or criminally. *Id.* Empirical evidence shows that a substantial portion of cases are prosecuted administratively. *Id.* at 156.

¹⁹⁰ For example, after the Exxon Valdez ran aground in 1989, a five month trial followed, and subsequent appeals carried the ordeal out for nearly two decades before the Supreme Court finally rendered the ultimate decision. Nina Totenberg, *Supreme Court Weighs Exxon Valdez Damages*, NPR, Feb. 27, 2008, <http://www.npr.org/templates/story/story.php?storyId=48308288>.

¹⁹¹ See generally JOHN BRAITHWAITE, *CRIME, SHAME AND REINTEGRATION* (1989) (discussing the deterrent effect of shame).

¹⁹² Mark A. Cohen, *Criminal Law as an Instrument of Environmental Policy: Theory and Empirics*, in *THE LAW AND ECONOMICS OF THE ENVIRONMENT* 198, 213 (Anthony Heyes ed., 2001) (citing Jonathan M. Karpoff et al., *Environmental Violations, Legal Penalties, and Repudiation Costs* (Univ. of Chi. John M. Olin L. & Econ. Working Paper No. 71 (2d series), 1998)).

¹⁹³ See *id.*

¹⁹⁴ See P. Fenn & C.G. Veljanovski, *A Positive Economic Theory of Regulatory Enforcement*, 98 *ECON. J.* 1055, 1055, 1068 (1988).

prosecutor only agrees to dismiss the case after evidence of compliance by the firm.¹⁹⁵ Some argue that this so-called “soft approach” in many cases leads to compliance by firms.¹⁹⁶ A problem with this approach is, however, that since the economic gain resulting from a violation of environmental statutes can be substantial, a firm that, after detection, only risks having to do what it had to do according to the law anyway has nothing to lose by violating. Violation, for instance by delaying an investment in environmental prevention equipment, can thus lead to substantial interest savings, basically without additional risks.¹⁹⁷ A substantial problem of under deterrence could hence follow.

d. Subjective Perceptions of Expected Sanctions

There may be a fourth reason why many firms comply not withstanding low expected sanctions under the criminal law. This is related to the fact that companies base their *ex ante* decision of compliance on their subjective perception of the probability of being detected and prosecuted and the sanctions that can be imposed.¹⁹⁸ They may hence not be aware of the low expected sanction in reality. The Belgian economist Rousseau found strong empirical backing for this phenomenon: when firms had to pay a monetary sanction during the previous two years they were on average more in violation in a second period than firms that did not have to pay a fine in the first period.¹⁹⁹ The interpretation is clear: those who did not have to pay a fine before overestimated the expected fine and complied.²⁰⁰ Firms that were recently fined had a more accurate impression of true expected sanctions and, being aware that they were low, were not deterred any longer.²⁰¹ This has an important policy implication: fining a polluter with too low a fine can have a perverse learning effect: firms will then be informed about the low expected sanction, whereas those

¹⁹⁵ See Charles R. Toy & A. Michael Leffler, *Criminal Enforcement of Environmental Law*, MICH. BAR J., Dec. 2001, at 21, 23.

¹⁹⁶ Billiet & Rousseau, *supra* note 167, at 18–19.

¹⁹⁷ This was argued with respect to the situation in the Netherlands by Andries Nentjes & J. Hommes, *Handhaving van het milieurecht*, TIJDSCHRIFT VOOR MILIEUAANSPRAKELIJKHEID 3 (1990).

¹⁹⁸ See Rousseau, *The Impact of Sanctions and Inspections*, *supra* note 176, at 17, 19 (noting that firms that are aware of the monetary restrictions are generally more likely to violate, implying that fears of sanctions may actually be more powerful than the sanction itself).

¹⁹⁹ *Id.*

²⁰⁰ *Id.*

²⁰¹ *Id.*

who were not confronted with these low sanctions may still wrongly believe that expected sanctions are higher than they actually are and thus be more induced towards compliance.²⁰² The policy implication seems to be that if the agency or court decides to fine a polluter it is better not to impose any fine at all than one too low, since otherwise one would destroy wrong, subjective perceptions of potential perpetrators that fines are higher than they actually are.

B. Enforcement Strategies

1. Deterrence or Cooperation?

A lot of theoretical literature has dealt with the question of whether authorities should be hard on polluters and should prosecute all cases, often referred to as the deterrence model, or whether negotiations between the polluter and the enforcer, whereby the agency tries to bring the polluter to compliance through persuasion and by providing information, referred to as the cooperation model, can be more effective.²⁰³ This cooperation strategy has the inherent risk that powerful and knowledgeable companies will de facto be able to control and “capture” the agency.²⁰⁴ In an empirical study with respect to environmental law enforcement in Denmark, May and Winter showed that cooperative enforcement was undermined by capturing.²⁰⁵ However, there is equally evidence that too strict a deterrence approach may produce counterproductive effects, for example when compliance is impossible as a result of practical difficulties and enforcement is hence felt as unreasonable.²⁰⁶ Especially in cases where administrative authorities are well informed and small- and medium-sized enterprises are not, a cooperative strategy could lead to a situation where the controlling agency in fact assists the enterprise towards compliance with environmental regulation.²⁰⁷

²⁰² *See id.*

²⁰³ *See* BENJAMIN VAN ROOIJ, REGULATING LAND AND POLLUTION IN CHINA: LAWMAKING, COMPLIANCE AND ENFORCEMENT; THEORY AND CASES 228–29 (2006).

²⁰⁴ *Id.* at 230.

²⁰⁵ Peter J. May & Søren Winter, *Regulatory Enforcement and Compliance: Examining Danish Agro-Environmental Policy*, 18 J. OF POL'Y ANALYSIS & MGMT. 625, 625–26, 633 (1999); *see also* van Rooij, *supra* note 203, at 230–31.

²⁰⁶ KEITH HAWKINS, ENVIRONMENT AND ENFORCEMENT, REGULATION AND THE SOCIAL DEFINITION OF POLLUTION 198–200 (1984).

²⁰⁷ *Cf.* Jason S. Johnston, *The Law and Economics of Environmental Contracts*, in ENVIRONMENTAL CONTRACTS: COMPARATIVE APPROACHES TO A REGULATORY INNOVATION IN

Criminological research in the Netherlands has shown that many violations of environmental regulation do not take place willfully, but rather as a result of a lack of information or knowledge.²⁰⁸ In these cases where companies lack adequate information, a deterrence approach may fail and a cooperative enforcement style could be more effective. This was also confirmed in a recent experimental study by Alpizar and others who showed that there are substantial learning effects, meaning that compliance with the desired pollution reduction targets is substantially higher in a second period when the firm was accurately informed about the contents of their obligations.²⁰⁹

The enforcement style followed in a particular legal system will of course not only depend upon the environmental goals to be achieved, but also upon differences, for example, in cultural values. Lofton argues that the difference in enforcement style between the United States, which has a strong deterrence-based enforcement style, and the United Kingdom, which follows more of a cooperative strategy, is related to differences in cultural values and attitudes concerning social regulation.²¹⁰ The threat of coercion has worked to ensure compliance with environmental regulation in the United States.²¹¹ Introducing a cooperative approach (which has worked in the United Kingdom) in the United States context could thus have disastrous consequences for environmental quality in the United States, given the strong opposition of American business to environmental regulation.²¹² If one agrees that varying enforcement styles are also related to cultural differences, the shift in the United States from traditional command and control to a more flexible system of industry self-regulation could therefore be a "dangerous journey," according to Steinzor.²¹³

THE UNITED STATES AND EUROPE 271, 288–89 (Eric W. Orts & Kurt Deketelaere eds., 2001) (discussing the importance of information in the creation of environmental contracts).

²⁰⁸ See generally Wim Huisman, TUSSEN WINST EN MORAAL, ACHTERGRONDEN VAN REGELNALEVING EN REGELOVERTREDING DOOR ONDERNEMINGEN (2001); Wim Huisman & Henk G. Van de Bunt, *Sancties, Organisatiecriminaliteit en Milieudelicten*, ARS AEQUI 684–97 (1997).

²⁰⁹ Francisco Alpizar et al., *Collective Versus Random Fining: An Experimental Study on Controlling Ambient Pollution*, 29 ENVTL. & RESOURCE ECON. 231, 247 (2004).

²¹⁰ See James A. Lofton, *Environmental Enforcement: The Impact of Cultural Values and Attitudes on Social Regulation*, 31 ENVTL. L. REP. 10906 (2001).

²¹¹ *Id.*

²¹² See *id.* (highlighting the distrust of public authority in the United States).

²¹³ See Rena I. Steinzor, *Reinventing Environmental Regulation: The Dangerous Journey from Command to Self-Control*, 22 HARV. ENVTL. L. REV. 103, 200–02 (1998).

2. Targeting Inspections

Previously, the low number of prosecutions of environmental crimes and the resulting low expected sanctions were mentioned.²¹⁴ This could be the result of efficient “targeting.” Given the high costs of criminal prosecution in some jurisdictions, it should not come as a surprise that systems have been developed whereby environmental agencies and prosecutors focus their efforts on specific categories of polluters or violations to achieve better results.²¹⁵ Arlen and Kraakman have suggested an enforcement strategy whereby firms are required to self-report a violation of pollution standards.²¹⁶ Voluntary reporting would be rewarded with lenient treatment, whereas prosecutors would focus enforcement efforts on violations which are not self-reported.²¹⁷ Also, others have argued that it may be effective to divide firms into different classes on the basis of their compliance behavior and focus enforcement efforts correspondingly.²¹⁸ Given limited agency assets to spend on inspections, an enforcement agency may engage in “regulatory dealing,” using tolerance in some contexts and increasing compliance for other types of violations.²¹⁹

There is empirical evidence to support the effectiveness of such a targeting strategy: Friesen showed that “by targeting enforcement efforts on specific segments of the regulated community, greater compliance with environmental regulations [could] be achieved.”²²⁰ The fact that an enforcement agency (such as an environmental protection agency) “shows a certain degree of tolerance with respect to specific violations” does not necessarily mean that the enforcement agency “goes soft,” but rather that it maximizes the available budget and thus the enforcement efforts.²²¹

²¹⁴ See *supra* Part III.A.1.

²¹⁵ Michael M. Stahl, *Doing What's Important: Setting Priorities for Environmental Compliance and Enforcement Programs*, in COMPLIANCE AND ENFORCEMENT IN ENVIRONMENTAL LAW: TOWARD MORE EFFECTIVE IMPLEMENTATION 159, 159, 166 (LeRoy Paddock et al. eds., 2011).

²¹⁶ Jennifer Arlen & Reinier Kraakman, *Controlling Corporate Misconduct: An Analysis of Corporate Liability Regimes*, 72 N.Y.U. L. REV. 687, 752–53 (1997).

²¹⁷ See *id.* at 690.

²¹⁸ Winston Harrington & Anthony Heyes, *The Theory of Penalties: 'Leverage' and 'Dealing,'* in THE LAW AND ECONOMICS OF THE ENVIRONMENT 185, 192–95 (Anthony Heyes ed., 2001).

²¹⁹ Anthony Heyes & Neil Rickman, *Regulatory Dealing—Revisiting the Harrington Paradox*, 72 J. OF PUB. ECON. 361, 363–64 (1999).

²²⁰ Lana Friesen, *Targeting Enforcement to Improve Compliance with Environmental Regulations*, 46 J. OF ENVTL. ECON. & MGMT. 72, 72, 82–83 (2003).

²²¹ *Id.*

Also, Rousseau recently showed that the environmental inspection agency in the Flemish Region in Belgium uses targeting to select firms it will routinely inspect and bases this selection on past compliance behavior and on received complaints.²²² “Firms are inspected more frequently as long as the environmental problem persists.”²²³ Once the problem is solved, “firms only receive routine inspections.”²²⁴ Hence, firms move relatively easily back to the “good” group.²²⁵ Rousseau argues that higher deterrence could be achieved by lowering the probability of escaping from the “bad” group, which is effectively equal to one in Flanders.²²⁶ Thus, the deterrence potential of targeting could even be better exploited.²²⁷

This literature confirms that targeting inspections and prosecutions may improve overall compliance. Also, Cohen showed that empirical literature finds a deterrent effect from increased inspections and government enforcement actions.²²⁸ Hence, even in the absence of frequent prosecutions, inspections can deter future violations.²²⁹ This is also shown in a recent study reviewing the empirical evidence concerning the effectiveness of environmental monitoring and enforcement: Gray and Shimshack also conclude that EPA enforcement actions lead both to specific, as well as general deterrence, and generate significant emission reductions as well.²³⁰

IV. OPPORTUNITIES AND CHALLENGES

This overview of some empirical research with respect to the effectiveness of various environmental instruments showed that many of those studies, even though they often originate from academic scholars

²²² Sandra Rousseau, *Timing of Environmental Inspections: Survival of the Compliant*, 32 J. REG. ECON. 17, 20, 31 (2007).

²²³ *Id.* at 34.

²²⁴ *Id.*

²²⁵ *Id.*

²²⁶ *Id.*

²²⁷ *Id.*

²²⁸ Mark A. Cohen, *Empirical Research on the Deterrent Effect of Environmental Monitoring and Enforcement*, 30 ENVTL. L. REP. 10245, 10251 (2000).

²²⁹ Heather Eckert, *Inspections, Warnings, and Compliance: The Case of Petroleum Storage Regulation*, 47 J. OF ENVTL. ECON. & MGMT. 232, 257 (2004).

²³⁰ See Wayne B. Gray & Jay P. Shimshack, *The Effectiveness of Environmental Monitoring and Enforcement: A Review of the Empirical Evidence*, 5 REV. OF ENVTL. ECON. & POL'Y. 3, 21–22 (2011); see also Jay P. Shimshack & Michael B. Ward, *Enforcement and Over-Compliance*, 55 J. ENVTL. ECON. & MGMT. 90, 90–91 (2008) (showing a similar result with regards to plant discharges).

other than lawyers, may provide interesting insights on the effects of environmental legal instruments. One reason for presenting this material was to show the opportunities this empirical research provides for environmental lawyers, but equally to point at a few challenges. There are a few rules of thumb to be followed when using this empirical research.

A. *Look at the Country Specific Context*

A first and obvious rule of thumb is to interpret the research results correctly, and more specifically within their particular context. For example, on the effectiveness of market-based instruments in developing countries there exists, as I showed above, a lot of different, and at first blush, seemingly contradicting research.²³¹ A skeptic of empirical research could, as is sometimes argued, hold that anyone can always find empirical research to backup his own position, whereby an adversary could equally find other research to backup his views. The key issue is of course that much of this research is very context-specific and the specific context, perhaps explaining why market-based instruments worked well in Colombia but maybe not in other developing countries,²³² should be interpreted within the specific institutional context of that country.

B. *Consider the Entire Environmental Legal Context*

A second, related point is that it may be dangerous to isolate results of one particular instrument from its use in the entire environmental legal context. For example, those studies pointing at the effectiveness of market-based instruments in fact equally showed that it was often not the market-based instrument itself that led to higher environmental performance, but the fact that the introduction of the instrument led to better environmental awareness and enforcement by agencies.²³³

Context specificity is also important when looking at one particular country case study. An example can be found in the case of India, where the Supreme Court has accepted public interest litigation in environmental cases.²³⁴ Recent research by economists has proven that environmental public interest litigation, and the resulting decisions of the

²³¹ See *supra* Part II.

²³² See Blackman, *supra* note 120, at 101–02.

²³³ See, e.g., *id.* at 117.

²³⁴ ARMIN ROSENCRANZ ET AL., ENVIRONMENTAL LAW AND POLICY IN INDIA: CASES, MATERIALS AND STATUTES 118–19 (1991).

Supreme Court in India, has led to a substantial reduction in pollution levels, more particularly, for example, as far as ambient air quality in Delhi is concerned.²³⁵ A straightforward policy conclusion following from this Indian case seems therefore to be that environmental public interest litigation is an effective instrument to reduce pollution levels in developing countries.²³⁶ Such a quick conclusion would, however, be wrong. First of all, even in India, many scholars hold that the judicial activism by the Supreme Court is desirable and effective, but only as a second best solution, given that the executive power fails to provide an adequate protection.²³⁷ Moreover, many authors in India are also critical of this judicial activism and argue that it seriously violates the separation of powers.²³⁸ Third, environmental public interest litigation may have generated beneficial effects in India since, in that country, the judiciary has a long-standing reputation of independence and decision-making in the public interest.²³⁹ The Indian solution may hence not be possible in countries where the judiciary is not of the same quality and the danger exists that problems of corruption and lacking capacity are as serious with the judiciary as with the legislative and executive branches of government.

C. *Be Honest in Interpreting the Results*

A third rule of thumb is that one obviously needs a certain academic honesty in using empirical research as well. One can often notice a hard-to-resist tendency among academics to use or interpret empirical research in a way that fits their established beliefs. Thus, for skeptics of market-based instruments like emission trading, the European experience could easily give rise to the comments that the emission trading scheme

²³⁵ A.V. Raja & Francis Rathinam, *Economic Efficiency of Public Interest Litigations (PIL): Lessons from India* 13, 18 (Munich Pers. RePEc Archive, Paper No. 3870), available at <http://mpira.ub.uni-muenchen.de/3870/>.

²³⁶ See Michael G. Faure & A.V. Raja, *Economic Analysis of Public Interest Litigation in Environmental Cases in India*, in *ECONOMIC ANALYSIS OF LAW IN INDIA: THEORY AND APPLICATION* 185, 185–86 (P.G. Babu et al. eds., 2010).

²³⁷ See J. Mijin Cha, *A Critical Examination of the Environmental Jurisprudence of the Courts of India*, 10 *ALB. L. ENVTL. OUTLOOK J.* 197, 198, 206–08 (2005); see also Lavanya Rajamani, *Public Interest Environmental Litigation in India: Exploring Issues of Access, Participation, Equity, Effectiveness and Sustainability*, 19 *J. ENVTL. L.* 293, 293–96 (2007).

²³⁸ Shubhankar Dam, *Green Laws for Better Health: The Past that Was and the Future that May Be—Reflections from the Indian Experience*, 16 *GEO. INT'L ENVTL. L. REV.* 593, 609–10 (2004); see also T.C.A. Anant & Javir Singh, *An Economic Analysis of Judicial Activism*, 37 *ECON. & POL. WKLY.* 4433, 4433 (2002).

²³⁹ See Rajamani, *supra* note 237, at 293–94.

apparently was ineffective since the price of an allowance dropped below €1.²⁴⁰ As was, however, shown above,²⁴¹ this would be a wrong interpretation of the ETS, since the low price may well be the result of substantial investments made prior to the ETS, as a result of which there was indeed less demand for allowances.²⁴²

D. Respect the Theoretical Context

A fourth rule of thumb is that the results of empirical research need always to be interpreted within a specific theoretical context. For example, the fact that in some cases, strict liability led to more pollution incidents than negligence, and to a tendency to organize in smaller business units,²⁴³ should not wrongly be interpreted as an argument against strict liability for environmental pollution. It should be seen, rather, in the light of the theoretical literature warning that strict liability may lead to under deterrence in case an insolvency risk emerges.²⁴⁴ That is, so the theoretical literature holds, as such not an argument against strict liability, but rather a reason to accompany it with solvency guarantees.

Many more examples have been given above, all pointing in the same direction: empirical research does provide many opportunities and useful information for environmental lawyers, but has to be interpreted with caution. That is no reason against using or doing empirical research, but rather a challenge to interpret the results within the right context.

CONCLUSION

In the introduction, it was argued that on the one hand this paper wanted to show that there is a lot of empirical research out there that has important lessons for environmental lawyers, even if it is not always easily accessible because of the language in which it is written or the type of journals in which it is published. A lot of this empirical material is already known to, and read by, environmental lawyers, and this will only become more important in the future.

It is indeed crucial for any policy instrument, be it command and control or market-based, that the policy maker has at least some ideas on

²⁴⁰ See *supra* Part II.E.2.

²⁴¹ See *supra* Part II.E.2.

²⁴² See *supra* Part II.E.2.

²⁴³ See *supra* Part II.A.2.

²⁴⁴ See Shavell, *supra* note 53, at 45–46.

the effects of the instruments chosen in practice. This requires, *ex ante*, taking into account available empirical research, since the choice for a particular instrument is often based on assumptions upon its effects, which may be merely theoretical.²⁴⁵ It also requires serious *ex post* evaluation studies to examine whether a particular instrument chosen or policy instrument implemented was indeed able to achieve the goals expected by the legislator.²⁴⁶

As far as the contents are concerned, a “tour d’horizon” of many environmental policy instruments was provided while realizing that this could not be complete. Some “cherry picking,” simply showing that on many domains interesting research exists worth further exploring, was the other main goal of this paper.

Maybe one conclusion, looking at the many studies discussed, could be that the empirical research does not necessarily point in the direction of strongly favoring either command and control or market-based instruments, but rather shows that the effectiveness of the instruments chosen depends to a large extent upon the particular design.²⁴⁷ Some studies point at the relative effectiveness of environmental taxation in providing incentives for emission reductions.²⁴⁸ At first blush, one could argue that this could be understood given the fact that command and control is so strongly dependent upon public enforcement, while it was shown that

²⁴⁵ See THE IMPACT OF LEGISLATION: A CRITICAL ANALYSIS OF EX ANTE EVALUATION 5–6 (Jonathan Verschuuren ed., 2009).

²⁴⁶ See Tom Tietenberg, *Tradable Permits in Principle and Practice*, in MOVING TO MARKETS IN ENVIRONMENTAL REGULATION: LESSONS FROM 20 YEARS OF EXPERIENCE 63, 64–65 (Jody Freeman & Charles D. Kolstead eds., 2007) (arguing that it is difficult to evaluate the effectiveness of tradable permit programs since many arise against the backdrop of prescriptive regulation requirements). The OECD has also developed mechanisms to verify compliance with environmental regulation. See ORG. FOR ECON. COOPERATION & DEV., WORKING PARTY ON NAT’L ENVTL. POLICIES, ENVIRONMENTAL COMPLIANCE ASSURANCE SYSTEMS: A CROSS-COUNTRY ANALYSIS 76 (2008), available at [http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=ENV/EPOC/WPNEP\(2008\)8/FINAL&docLanguage=En](http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=ENV/EPOC/WPNEP(2008)8/FINAL&docLanguage=En). See generally ORG. FOR ECON. COOPERATION & DEV., ENSURING ENVIRONMENTAL COMPLIANCE: TRENDS AND GOOD PRACTICES (2009); Eugene Mazur, *Outcome Performance Measures of Environmental Compliance Assurance: Current Practices, Constraints and Ways Forward* (Org. for Econ. Cooperation & Dev., Working Paper No. 18, 2010), available at <http://dx.doi.org/10.1787/5kmd9j75cf44-en>.

²⁴⁷ This point is also advocated by Driesen, who argues that both traditional regulation and trading have often failed to produce innovation, but have also sometimes succeeded. He also stresses the importance of design in regulation. David M. Driesen, *Design, Trading and Innovation*, in MOVING TO MARKETS IN ENVIRONMENTAL REGULATION: LESSONS FROM 20 YEARS OF EXPERIENCE 436, 450–51, 456 (Jody Freeman & Charles D. Kolstead eds., 2007).

²⁴⁸ See *supra* Part II.D.1.

(at least in Western Europe) it may be weak, due to low expected sanctions *ex ante*. However, studies equally showed that the tax rate is not always efficiently set and that taxation was effective only in those systems where an effective monitoring and enforcement system was applied.²⁴⁹ In that respect, command and control and market-based approaches are not that much different: both will need effective monitoring and enforcement systems.

The studies equally showed that it may not be possible to argue that one particular instrument is “best” or “optimal,” but that in most cases, a combination of various instruments may be needed.²⁵⁰ An important point for further research is hence to look for these “optimal mixes” of policy instruments, and these may also to a large extent depend upon country specific characteristics. It was therefore not surprising to notice that important differences exist, for example, between Europe and the United States.²⁵¹ To some extent, these differences (for example with instruments chosen, but also enforcement styles) may be due to institutional characteristics, or simply differences in the environmental problems of the countries concerned. However, a lot of studies also showed that in practice, one may often notice that optimal instruments are not introduced simply because of lacking political acceptability. Hence, the reason why the United States had more emission trading and Europe more environmental taxation, and why initially emission rights in Europe were allocated through grandfathering, is often the result of the relative power of the various interest groups involved.²⁵² In this respect, the recent study by Binder and Neumayer showing that the influence of the civil society has a positive impact on environmental quality gives important empirical support for an issue that environmental lawyers already long were convinced of: if one wishes governments to make environmental regulation in the public interest, it is very important to have environmental NGO involvement in order to provide a good counterweight for lobbying by interest groups representing industry.²⁵³

²⁴⁹ See *supra* Part II.D.2.

²⁵⁰ See Winston Harrington & Richard D. Morgenstern, *International Experience with Competing Approaches to Environmental Policy: Results from Six Paired Cases*, in *MOVING TO MARKETS IN ENVIRONMENTAL REGULATION: LESSONS FROM 20 YEARS OF EXPERIENCE* 95, 137 (Jody Freeman & Charles D. Kolstead eds., 2007) (arguing that, in practice, regulators often use a mix of command and control and economic incentive instruments).

²⁵¹ See *supra* Part II.D.2 & Part III.B.1 (contrasting the United States with the United Kingdom).

²⁵² See *supra* Part II.D.3.

²⁵³ See Binder & Neumayer, *supra* note 24, at 536–37; *supra* Part II.B.3.

This contribution started with a discussion of the important research by Esty and Porter.²⁵⁴ They, on the one hand, showed that environmental quality does to a large extent depend upon economic growth. The most important lesson for those who want improvement of environmental quality therefore still remains: fight poverty and increase income levels. However, at the same time, their (and other) research equally showed that environmental quality is higher in those legal systems with a decent regulatory and institutional framework.²⁵⁵ Therefore, it does pay to examine, based on empirical research, which environmental instruments may in particular contexts be most effective in remedying environmental pollution.²⁵⁶ This paper tried to show how empirical research can provide an important contribution in this respect.

²⁵⁴ Esty & Porter, *supra* note 19.

²⁵⁵ *Id.* at 391.

²⁵⁶ Meanwhile, proposals have been formulated to increase the effectiveness of environmental law and policy. *See generally* DAVID SCHOENBROD ET AL., BREAKING THE LOGJAM: ENVIRONMENTAL PROTECTION THAT WILL WORK (2010); COMPLIANCE AND ENFORCEMENT IN ENVIRONMENTAL LAW: TOWARD MORE EFFECTIVE IMPLEMENTATION (LeRoy Paddock et al. eds., 2011).