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THE ECONOMIC DYNAMICS OF ENVIRONMENTAL LAW: COST-BENEfiT ANALYSIS, EMISSIONS TRADING, AND PRIORITY-SETTING

DAVID M. DRIESEN*

Abstract: An economic dynamic approach to environmental law offers a more promising avenue for regulatory reform that the current static-efficiency-based approach. An economic dynamic approach seeks to emulate the creativity and innovation that free markets sometimes produce, instead of the efficiency that the economists ascribe to it for purposes of economic modeling. Environmental law must cope with a predictable set of economic dynamics. Population and consumption increases tend to increase pollution and natural resource destruction over time while empowering dirty old industries. We need a reform agenda focused on regulatory design that encourages innovations adequate to cope with significant environmental change over time. Such an agenda would emphasize changes in regulatory process to reduce the influence of existing dirty industries, regulatory designs that encourage innovation, and creative efforts to circumvent problems with languid and sometimes ineffectual governmental decisionmaking processes.

INTRODUCTION

This symposium issue includes articles from contributors to the conference on Economic Dynamics of Environmental Law and the Static Efficiency, held at Syracuse University College of Law in October of 2003. The conference, and hence this symposium issue, contrasts major points of view regarding directions for reform. One view involves an emphasis on reforms having their origins in ideals of economic efficiency. A contrasting view emphasizes changes over time,

* Professor, Syracuse University College of Law; J.D. Yale Law School, 1989. I would like to thank Dean Hannah Arterian for suggesting the conference at Syracuse University College of Law that generated the papers for this symposium issue, Zygmunt Plater for arranging publication with the *Boston College Environmental Affairs Law Review*, Chris Ramsdell and Theresa Coulter for their work in organizing the conference, and all of the participants in the conference for a lively exchange of ideas. Portions of this Essay are based on THE ECONOMIC DYNAMICS OF ENVIRONMENTAL LAW, a book written by the author and published in 2003.

uncertainty and pressure on regulatory agencies to do little or nothing. I have developed this second point of view in a recently published book, *The Economic Dynamics of Environmental Law.*[1] This article will explain this theory and use it to address three topics: cost-benefit analysis, emissions trading, and priority-setting. It will also show how an economic dynamic theory suggests a fresh agenda for regulatory reform—an agenda addressing the key questions that the theory raises about how to allow environmental law to adequately cope with change over time.

Part I explains the standard efficiency-based view and how it has led to widespread support for cost-benefit analysis and emissions trading. Part II offers a general economic dynamic critique of these recommendations. Part III proposes some alternatives.

I. The Efficiency-Based Reform Agenda

Many economists and policy experts view environmental policy through a neoclassical economic efficiency lens. This lens has led to criticism of environmental law as based on poor priority-setting and to increased reliance upon cost-benefit analysis (CBA) in determining the goals of environmental regulation and environmental benefit trading as the principle means of obtaining those goals.[2]

A. *Priority-Setting*

Regulated corporations, the think tanks they finance, and some academics have criticized regulatory programs as reflecting poor priority-setting. In making this criticism, they rely upon tables purporting to show the dollars of regulatory expenditures per life saved under various rulemaking initiatives.[3] These tables suggest that the dollars expended per life saved vary quite widely from regulation to regulation. Lisa Heinzerling has shown that these tables present very misleading data.[4] While regulatory reformers have treated them as com-

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[1] David M. Driesen, The Economic Dynamics of Environmental Law (2003).

[2] *See, e.g.*, Stephen Breyer, Breaking the Vicious Circle: Toward Effective Risk Regulation (1993) (claiming that environmental law suffers from poor priority-setting); Thomas O. McGarity, *A Cost-Benefit State*, 50 Admin. L. Rev. 7, 39–40 nn.155–58 (1998) (citing other regulatory reformers' priority-setting arguments); Richard H. Pildes & Cass R. Sunstein, *Reinventing the Regulatory State*, 62 U. Chi. L. Rev. 1, 86–89 (1995) (advocating cost-benefit analysis to cure poor priority-setting).

[3] Lisa Heinzerling, *Regulatory Costs of Mythic Proportions*, 107 Yale L.J. 1981, 1983, 1993–98 (1998) (describing the influence of tables denoting dollars per lives saved).

[4] *Id.* at 1998–2042.

pendiums of agency cost estimates for real regulations, many of the regulations listed were never enacted.[5] Furthermore, the cost estimates for enacted regulations come from the authors of the tables, not from the administrative agencies that developed the regulations. But a more fundamental puzzle involves the question of why anybody would think that uneven dollars per lives saved indicates poor priority-setting.[6] If we gave high priority to the most serious hazards and low priority to less serious hazards, the cost of remedial measures might still be very uneven. Some hazards just cost more to remedy than others. It is not obvious that dollars per life saved should be approximately equal across regulation.[7]

The reliance on these tables as evidence of poor priority-setting assumes that regulations should generate approximately even dollar expenditures per life saved. But a moment's reflection suggests that this idea is deeply problematic. Many environmental regulations aim to address widespread illness and ecological damage as well as, or rather than, death.[8] Regulatory reformers, however, do not explicitly argue that priority-setting should ignore illness and ecological damage, as their approach does.[9]

While regulatory reformers never explain why they think this sort of data provides significant information about priority-setting, the economic efficiency ideal can help explain why this belief appears sensible to some people.[10] For, as we shall see, the economic efficiency ideal assumes that the costs of each government regulation should approximately equal the dollar value economists associate with the benefits each regulation generates. If one accepts this assumption, it may seem natural to assume that unevenness of expenditures involves some defect in priority-setting.

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[5] *Id.* at 1984.

[6] *See* David M. Driesen, *Getting Our Priorities Straight: One Strand of the Regulatory Reform Debate*, [2001] 31 Envtl. L. Rep. (Envtl. L. Inst.) 10,003, 10,017 (Jan., 2001).

[7] *Id.* at 10,017–18.

[8] *See generally* Lisa Heinzerling, *Political Science*, 62 U. Chi. L. Rev. 449 (1995) (book review).

[9] *Cf. id.* at 470 (discussing Justice Breyer's implicit view that the proper goal of risk regulation is to save human lives).

[10] For a more extended treatment of how economic efficiency might help explain regulatory reformers' priority-setting arguments, and an extended critique of this approach, see Driesen, *supra* note 6.

B. *Cost-Benefit Analysis*

Economists like CBA of environmental regulation, because they believe that it helps make regulation better conform to neoclassical ideals of allocative efficiency. A project is allocatively efficient if its benefits match its costs.[11] This efficiency idea comes from a model of free markets that assumes that buyers only pay as much for a good as it is worth to the purchaser.[12] Economists implicitly analyze regulation preventing harms as the purchase of a good, and assume that the regulator should pay no more than the good (environmental quality) is worth to the public consumers of clean air, water, and land. They treat the environment like a commodity, rather than as a system of life upon which we depend.[13]

While most of the environmental statutes aim to protect public health and the environment, policy-makers have increased reliance upon CBA in recent years. Presidents Reagan, Bush, Sr., and Clinton promulgated executive orders calling for more CBA, and Congress ratified these orders in 1995.[14] Thus, CBA has become influential in establishing the goals of environmental regulation.

CBA depends upon quantifying the harms regulations avoid—the benefits of avoided death, illness, and ecological destruction—in dollar terms and projecting future costs.[15] Science rarely permits reasonably precise estimates of the amount of health or environmental damage a particular regulation will avoid.[16] In order to facilitate comparison of avoided harm with costs, economists ascribe dollar values to conse-

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[11] *See* WILLIAM J. BAUMOL & WALLACE E. OATES, THE THEORY OF ENVIRONMENTAL POLICY 23 (1975) (misallocation of resources can be fixed by charging price, or tax, equal to the social cost).

[12] *See* David M. Driesen, *The Societal Cost of Environmental Regulation: Beyond Administrative Cost-Benefit Analysis*, 24 ECOLOGY L.Q. 545, 578-79 (1997).

[13] *See, e.g.*, JACK MANNO, COMMODITIZATION AND ITS IMPACT ON ENVIRONMENT AND SOCIETY 223 (2000) (questioning the treatment of environmental quality as a commodity); MARK SAGOFF, THE ECONOMY OF THE EARTH 1100 (1988) (arguing that environmental protection should be based on debates about values, not summation of individual "preferences").

[14] *See* Unfunded Mandates Reform Act of 1995, Pub. L. No. 104-4, § 202, 109 Stat. 48 (codified at 2 U.S.C. § 1532 (1995)).

[15] *See* DRIESEN, *supra* note 1, at 21–23.

[16] *See* McGarity, *supra* note 2, at 13 (discussing problem of data gaps rendering risk assessments, the basis for benefits estimates, incomplete and uncertain); *see, e.g.*, Thomas O. McGarity, *Politics by Other Means: Law, Science, and Policy in EPA's Implementation of the Food Quality Protection Act*, 53 ADMIN. L. REV. 103, 120–92 (2001) (describing in detail the data gaps and judgments needed to assess risk under the Food Quality Protection Act).

quences like death and illness.[17] The valuation methodology involves numerous controversial value assumptions.[18]

Rather than leading to a series of finely balanced decisions, CBA has tended to prevent administrative agencies from making any decisions. It has thoroughly paralyzed efforts to impose regulatory restrictions under the Toxic Substances Control Act and of the Federal Insecticide, Fungicide, and Rodenticide Act, the two federal environmental statutes that rely upon it most heavily.[19] A major problem involved the government's inability to quantify even well-understood dangers. A court, for example, rejected an Environmental Protection Agency (EPA) ban on asbestos, in part because EPA put too much emphasis on then unquantifiable health damage from asbestosis.[20] We now know that asbestos caused so much damage that compensation of victims bankrupted the asbestos industry.[21] Calculation of the value of harms a regulation could avoid tends to paralyze agencies, because substantial uncertainties always bedevil such accounting, even when the harms are obvious and very serious.[22]

The Syracuse University College of Law conference generated some interesting discussion about the notion that CBA aids priority-setting. Advocates of this point of view have never explained precisely how it does that. Priority-setting usually refers to decisions about which things to regulate (agenda-setting), and in which order to regulate (ordering). The argument that CBA aids priority-setting suggests that movement toward a "cost-benefit state" merely involves decisions about ordering.[23] In fact, CBA usually addresses stringency, not priority-setting.[24]

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[17] *See* Frank Ackerman & Lisa Heinzerling, *Pricing the Priceless: Cost-Benefit Analysis of Environmental Protection*, 150 U. PA. L. REV. 1553, 1553 (2002) (describing CBA as reducing benefits into dollars and cents to the extent possible).

[18] *See generally* FRANK ACKERMAN & LISA HEINZERLING, PRICELESS: ON KNOWING THE PRICE OF EVERYTHING AND THE VALUE OF NOTHING (2004) (describing many of the value assumptions employed in converting environmental and health benefits into dollars).

[19] *See* Driesen, *supra* note 12, at 601–05; Donald Hornstein, *Lessons from Federal Pesticide Regulation on the Paradigms and Politics of Environmental Law Reform*, 10 YALE J. ON REG. 369, 422 (1993) (describing an "analytical treadmill" making progress on pesticide regulation "strenuous if not impossible").

[20] Corrosion Proof Fittings v. Envtl. Prot. Agency, 947 F.2d 1201, 1219 (5th Cir. 1991). For a critique of this decision, see Thomas O. McGarity, *The Courts and the Ossification of Rulemaking: A Response to Professor Seidenfel*, 75 TEX. L. REV. 525, 541–49 (1997).

[21] *See* Driesen, *supra* note 12, at 596.

[22] *See id.* at 594 (noting that EPA lacks information on health effects of the majority of toxic chemicals to which Americans are exposed).

[23] *See* Driesen, *supra* note 6, at 10,004.

[24] *Id.*

Some advocates of CBA probably view it as an appropriate aid to ordering.[25] Advocates of CBA may imagine that government should schedule regulation to give priority to standards offering the most benefit per dollar.[26] This idea raises serious questions in theory and is utterly impracticable. The regulation offering the best cost-benefit ratio might not be the regulation addressing the most serious health hazard.[27] Thus, this CBA ordering principal might allow more people to die—during the time interval before the lower priority regulations are imposed—than a worst-things-first principle.

Pragmatically, implementation of this approach would require agencies to establish the costs and benefits of rules at the stage when they order their activities, rather than when they write standards. But the costs and benefits of rules hinge upon stringency decisions and require huge amounts of information. Agencies cannot possibly decide upon the stringency of each regulation in advance for a variety of reasons. If an agency had enough people to make all these decisions at once, then it would not need to engage in any priority-setting. Priority-setting is needed precisely because it is so difficult to assess the costs and benefits of regulation.[28]

Indeed, even if it were possible to gather information on every regulation at once, that information would be stale by the time the agency actually regulated. Often the cost of environmental technology comes down over time, and knowledge about health impacts changes with further study.[29] Thus, the notion that CBA aids priority-setting involves a failure to understand very basic things about regulation, and even the reasons why some priority-setting is needed.

C. *Environmental Benefit Trading*

Economists and like-minded lawyers have also recommended environmental benefit trading programs as a means of enhancing the cost-effectiveness of environmental programs, another type of

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[25] *See id.* at 10,018. While this has rarely been explicit in regulatory reformers' writing, it has been implicit. During the Economic Dynamics conference, at least one participant explicitly defended the idea that CBA aids ordering.

[26] A participant in this conference explicitly advocated this idea.

[27] *See* Driesen, *supra* note 6, at 10,018–19 (discussing these and other possible priority-setting principles).

[28] *Cf. id.* at 10,018 (discussing the problem of CBA-based priority-setting exercises consuming resources that could be devoted to protecting public health).

[29] *See e.g.*, David M. Driesen, *Markets Are Not Magic*, 20 ENVTL. F. 19, 24 (2003) (discussing example of renewable energy's falling cost).

efficiency.[30] These programs allow polluters to forego required environmental improvements if they pay somebody else to make equivalent improvements in their stead.[31] This allows polluters to redistribute their pollution control obligations to achieve required reductions at the lowest possible cost. These programs have come to dominate United States policy.[32]

Thus, benefit trading programs involve the use of efficiency, in the sense of cost-effectiveness, to guide choices about the means of environmental protection. While some of these programs have proven successful, the popularity of "market mechanisms" enhancing regulatory "efficiency" has led to overuse of the technique and design failures.[33] When states have applied these programs to unmonitored pollutants, for example, they have often failed miserably in achieving environmental goals.[34]

II. An Economic Dynamic Alternative

Economic dynamic analysis calls into question the notion that static efficiency is important enough to merit the obsessive attention it has received. After all, technical progress, a response to economic dynamics, has provided a large contribution to the growth of industrial economies relative to that provided by increased inputs of capital and

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[30] *See* Bruce A. Ackerman & Richard B. Stewart, *Reforming Environmental Law: The Democratic Case for Market Incentives*, 13 Colum. J. Envtl. L. 171 (1988); Robert W. Hahn & Robert N. Stavins, *Incentive-Based Environmental Regulation: A New Era from an Old Idea?*, 18 Ecology L.Q. 1 (1991).

[31] *See* Driesen, *supra* note 29, at 21.

[32] *See* David M. Driesen, *Is Emissions Trading an Economic Incentive Program?: Replacing the Command and Control/Economic Incentive Dichotomy*, 55 Wash. & Lee L. Rev. 289, 291–92 (1998); *see, e.g.*, Royal C. Gardner, *Banking on Entrepreneurs: Wetlands, Mitigation Banking, and Takings*, 81 Iowa L. Rev. 527 (1996) (reviewing an intertemporal trading program for wetlands conservation); Ann Powers, *Reducing Nitrogen Pollution on Long Island Sound: Is There a Place for Pollutant Trading?*, 23 Colum. J. Envtl. L. 137 (1998) (discussing proposal to use nitrogen trading regionally to control water pollution).

[33] *See, e.g.*, Approval and Promulgation of Air Quality Implementation Plans; New Jersey; Open Market Emissions Trading Program, 67 Fed. Reg. 64,347 (Oct. 18, 2002) (announcing EPA decision not to proceed with processing New Jersey State Implementation Plan revisions, because New Jersey had found such serious problems in its emissions trading program that it was planning to abandon it); Richard Toshiyuki Drury et al., *Pollution Trading and Environmental Injustice: Los Angeles' Failed Experiment in Air Quality Policy*, 9 Duke Envtl. L. & Pol'y F. 231, 258–63 (1999) (discussing fraud in the estimation of credits that undermines environmental performance).

[34] *See, e.g.*, Drury, *supra* note 33, at 258–63 (discussing problems with trading volatile organic compounds).

labor.[35] This means that frequently inefficient creativity and experimentation play a major role in creating wealth.[36]

Indeed, even that part of economic growth that comes from increased inputs of capital and labor responds in part to economic dynamics. And analysis of the desirable amounts of these inputs in economic theory involves questions of macroeconomic intertemporal efficiency, rather than only static microeconomic allocative efficiency.

Economists define allocative efficiency in terms of matching supply and demand for a given technological state, an aspect of microeconomic theory. I refer to efficiency concepts that assume an unchanging technological state as "static efficiency" concepts. Economists generally address determinants of rates of innovation and economic growth as a macroeconomic topic separate from static efficiency concerns. Indeed, the proposition that perfect static allocative efficiency contributes more to economic growth than a less efficient allocation is controversial in the economics profession. A debate has raged between economists about whether perfect competition is good for economic growth, even though all concede that perfect competition is necessary for optimum static allocation of goods and services.[37] Perfect competition (a precondition for static efficiency) benefits consumers by lowering prices to the point that profits diminish. But lower profit levels may make investment in technological innovation difficult, thus retarding economic growth.[38]

Equilibriums come and go as the economy grows and changes over time.[39] Temporary static equilibriums may simply not matter very much in the long run.[40]

If the economy changes drastically, growing in scale, then the relationship of this growth to the earth's carrying capacity—the issue of

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[35] MICHAEL COMMON, SUSTAINABILITY AND POLICY: LIMITS TO ECONOMICS 139 (1995); NATIONAL SCIENCE AND TECHNOLOGY COUNCIL, TECHNOLOGY FOR A SUSTAINABLE FUTURE 2 (1994); Michael Barrows & Jay Stowsky, *Technology Policy and Economic Growth, in* INVESTING IN INNOVATION: CREATING A RESEARCH AND INNOVATION POLICY THAT WORKS 41 (Lewis M. Branscomb & James H. Keller eds., 1998).

[36] ROBIN PAUL MALLOY, LAW AND MARKET ECONOMY: REINTERPRETING THE VALUES OF LAW AND ECONOMICS 78–99, 137 (2000).

[37] *See* JOHN BATES CLARK, ESSENTIALS OF ECONOMIC THEORY 374 (1907); JOHN KENNETH GALBRAITH, AMERICAN CAPITALISM: THE CONCEPT OF COUNTERVAILING POWERS 14–18 (1952); IV J.S. MILL, PRINCIPLES OF POLITICAL ECONOMY, ch. VII, § 7 (3d ed., Parker & Son 1852) (1848); JOSEPH A. SCHUMPETER, CAPITALISM, SOCIALISM, AND DEMOCRACY 78 (2d ed. 1947).

[38] EDWIN MANSFIELD, THE ECONOMICS OF TECHNICAL CHANGE 104–06 (1968).

[39] DRIESEN, *supra* note 1, at 4.

[40] *Id.* at 5.

scale—becomes more important than efficiency, even if one accepts a wealth creation goal.[41] Efficiency, after all, simply allocates fixed resources. It neither augments resources, as economic development does, nor diminishes available resources, as natural resource depletion does.

The kind of static efficiency that economists use to model markets has little relation to very important free market virtues one might wish to emulate. Surely, many people admire the free market's tendency to reward innovation and change that betters people's material lives. Economic growth, in part a byproduct of technological change, has long been the most sought after public benefit from a free market.[42]

The importance of technological change in delivering desirable public benefits from the free market suggests that we should pay serious attention to change over time. Making technological change central introduces a temporal dimension to the study of environmental policy. The direction of change over time becomes important and questions about cost must include thinking about cost over a long period of time.

One might well want public law to stimulate innovation to better meet public goals. But innovation and growth frequently require experimentation. And experimentation often implies failure and inefficiency.[43] In short, some tension exists between sound economic dynamics and perfect static efficiency.[44]

A brief description of economic dynamics should prove helpful. Most fundamentally, economic dynamics focuses upon change over time.

The idea of an economic dynamic analysis of law follows from some of the insights of institutional economists. In particular, institutional economics and organizational theory assume that institutions, such as government agencies and corporations, make decisions using a form of "bounded rationality."[45] Institutions' purposes and habits combine with a lack of comprehensive information to constrain the

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[41] *See* HERMAN E. DALY, BEYOND GROWTH: THE ECONOMICS OF SUSTAINABLE DEVELOPMENT 221 (1996); Douglas A. Kysar, *Sustainability, Distribution, and the Macroeconomic Analysis of Law*, 43 B.C. L. REV. 1 (2001).

[42] *See* DYNAMICS, ECONOMIC GROWTH, AND INTERNATIONAL TRADE 31 (Bjarne S. Jensen & Kar-yiu Wong eds., 1997).

[43] *See* MALLOY, *supra* note 36, at 85.

[44] DOUGLASS C. NORTH, INSTITUTIONS, INSTITUTIONAL CHANGE AND ECONOMIC PERFORMANCE 81 (1990).

[45] Oliver E. Williamson, *Chester Barnard and the Incipient Science of Organization*, *in* ORGANIZATION THEORY: FROM CHESTER BARNARD TO THE PRESENT AND BEYOND 172, 178–79 (Oliver E. Williamson ed., 1995).

choices that they make. Their business and habits may make them more aware of some kinds of information and not others, and more prone to some kinds of actions and not others.

Furthermore, decisionmaking by institutions is "path dependent." Past actions and decisions tend to constrain the range of attractive future decisions. Thus, for example, a corporation that owns a coal-fired power plant facing a decision about how to produce more electricity will likely focus upon options that involve running its existing plant in different ways—for example, decisions that continue along a past path. A new business deciding about how to sell electricity today may find building a new natural gas power plant attractive, for the lack of any prior commitments may make this the cheapest current option for that business.[46]

Douglass North has used these ideas of path dependence and bounded rationality to study institutional change over time. Of particular relevance to the economic dynamics of law, he focuses upon an idea of "adaptive efficiency," an aid to understanding the rules that shape economic evolution over time.[47] Adaptive efficiency concerns itself with the ability of a society to acquire knowledge, to experiment, and to creatively solve problems.[48] Under conditions of uncertainty, North claims, nobody knows the correct answer to the problems they confront, and therefore nobody knows precisely how to maximize profits.[49] Adaptive efficiency maximizes not present value, but future choice under conditions of uncertainty. It induces experiments with new methods and provides feedback mechanisms to allow for post-hoc correction of errors.[50]

An economic dynamic analysis of environmental law moves beyond merely noticing what incentives a particular law provides. It would ask how the incentive provided actually influences the people the incentive might influence, using the concept of bounded rationality as a tool. This includes noticing whether the law provides an incentive that falls within the matters an institution or individual will actually pay attention to, given the reality of bounded rationality. For example, the "tax on marriage" may provide an incentive not to marry, but the in-

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[46] ENVTL. LAW INST., CLEANER POWER: THE BENEFITS AND COSTS OF MOVING FROM COAL GENERATION TO MODERN POWER TECHNOLOGIES 4–5 (2001), http://www.elistore.org/reports_detail.asp?ID=519 (last visited Mar. 5, 2004).

[47] *See* NORTH, *supra* note 44, at 80.

[48] *Id.*

[49] *Id.* at 81.

[50] *Id.* at 99.

centive may not influence single persons' decisions about whether to marry because this factor lies outside the range of factors they will consider in making this particular choice. This implies a need for more detailed study of institutions and individual behavior.

In addition to noticing when bounded rationality makes an incentive ineffective, economic dynamic analysis of law would notice and account for non-legal incentives. Thus, even if strict standards for new pollution sources provide an incentive not to build new plants—as many scholars have argued—attributing a failure to modernize power plants to this incentive without observing other market factors that might influence modification decisions provides an incomplete analysis. Power plants must modernize because often old equipment wears out and only new equipment of different design is available to replace it.[51] Failing to modernize under that circumstance might make it impossible to generate power, and therefore, revenue. This incentive clearly would overcome any countervailing regulatory incentive. Market incentives may often prove more influential than the legal ones, overriding them in some cases, or rendering them redundant in others. In other words, economic dynamic analysis should include careful accounting for what is inside and outside the bounds of "bounded rationality," so that it takes notice of how law shapes, or fails to shape, society.

An economic dynamic analysis would also build on public choice analysis to better understand possible future directions for law.[52] Public choice analysis predicts that powerful interests have a disproportionate influence upon political decisions and thus upon the content of the law. Noticing whom the free market empowers and what sorts of legal rules these interests will want to pursue aids analysis of the future direction of legal rules.

This economic dynamic analysis also provides tools to understand what problems free markets will create over time. Private firms and individuals will generally consider the costs and benefits to themselves, not efficiency in the abstract, in deciding which innovations to pursue. Recognizing these bounds upon rationality provides a useful tool in

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[51] Prevention of Significant Deterioration (PSD) and Non-Attainment New Source Review (NSR): Equipment Replacement Provision of the Routine Maintenance, Repair and Replacement Exclusion, 68 Fed. Reg. 61,248, 61,253 (Oct. 27, 2003) (codified at 40 C.F.R. §§ 51.165–.166, 52.21) (indicating that advancing technology may force operators to replace old equipment with more modern equipment when the old equipment wears out).

[52] *See generally* JERRY MASHAW, GREED, CHAOS, AND GOVERNANCE: USING PUBLIC CHOICE TO IMPROVE PUBLIC LAW (1997).

predicting future trends stemming from private decisions about innovation.

We can now generally outline the idea of the economic dynamics of environmental law. An economic dynamic exists that tends to diminish environmental quality over time. Any person can realize a profit by taking a natural resource and converting it into a product for sale to human beings. Hence, the free market provides a continuous incentive to find and deploy environmentally degrading innovations in order to meet human material needs and desires. Indeed, the market provides an incentive for producers to encourage expanding material desires over time, through advertising. Population increases, a natural product of fundamental biological impulses, and human desires to have more stuff accelerate this dynamic tendency to increase resource use over time.

As the laws of thermodynamics explain, increased resource use over time diminishes the stock of useful resources that can sustain wealth. The second law of thermodynamics teaches that production converts low-entropy resources into high-entropy waste, which has less economic potential.[53] Thus, over time, use of nonrenewable resources or harvesting of renewable resources at rates exceeding their potential for renewal should lead to reductions in wealth.

While the free market offers substantial incentives to innovate in order to create more goods, it offers no strong, continuous incentive to innovate for the sake of improving environmental quality. The free market may encourage bigger cars that carry more people on rougher terrain, but it does little to encourage the most environmentally friendly automobile possible. The free market regularly encourages entrepreneurs to take big risks in order to try and earn money satisfying our material desires, but offers no incentive for such risk-taking for the sake of the environment.

The continuous possibility of profit from environmental degradation tends to limit countervailing government efforts toward preservation. People who make profits from environmentally-degrading activities acquire the means to hire lawyers and lobbyists to limit government efforts to protect the environment. And all of us have an incentive to favor reduced taxation, which limits the administrative capacity of government. Over time, these efforts have a rather profound effect.

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[53] DALY, *supra* note 41, at 65, 194–95. *See generally* NICHOLAS GEORGESCU-ROEGEN, THE ENTROPY LAW AND THE ECONOMIC PROCESS (1971).

Notice that this description focuses upon the macroeconomic picture, the large shape of society over time. This description concerns itself not just with the effects this dynamic may have on any given government or private decision. It concerns itself with how many decisions implementing change might occur over time. Because the free market is more decentralized than the government, many more potentially environmentally degrading private decisions will be made than countervailing government decisions. If the number of private innovations protecting the environment falls far behind the number of private decisions harming the environment, then long-term environmental degradation will prove very difficult to avoid.

This dynamic, once properly understood, should reshape our thinking about environmental law. The question of how to make each governmental regulation efficient becomes less important than that of how to address this larger dynamic. Since the number of regulatory decisions per unit of time will tend to remain small relative to the number of private decisions that do not internalize environmental costs, the dynamic suggests that a set of perfectly efficient regulatory decisions will not lead to a perfectly or even largely efficient economy. This theory should influence both those who believe that efficiency is the proper goal of environmental protection and those who do not. Either way, the underlying dynamic is important.

The theory of economic dynamics not only leads to a different description of the macroeconomics of environmental law, and thereby to different questions about how to achieve the normative goals of environmental law, it also provides tools for critiquing legal rules and their effects upon innovation and change. This micro-level analysis calls into question the conventional wisdom regarding regulatory design.

Economic dynamic analysis of environmental law has four uses. First, it provides a basis for critiquing the efficiency-based prescriptions for regulatory reform. Second, it should change our analysis of environmental law and policy, reshaping our perception of what constitutes its most important characteristics. Third, it should change the questions we focus upon in thinking about reform of environmental law, inviting us to ask how to alter the dynamics that determine long-term performance. Fourth, it improves the precision of analysis leading to new reform recommendations. This article will employ the theory to provide a critique of several efficiency-based recommendations for environmental law and then show how the theory raises new questions about environmental policy and law.

III. Economic Dynamic Critique of Efficiency-Based Policies

Economic dynamic analysis emphasizes change over time, systematic change, and precise analysis of how incentives affect individuals and institutions.[54] This distinguishes it from efficiency-based analysis, which is static, focused on an individual transaction, frequently employs vague and incomplete analysis of an incentive's impacts, and often ignores institutional considerations.[55] This Part briefly examines some of the questions it raises about priority-setting, cost-benefit analysis, and emissions trading.

A. *Efficiency-Based Priority-Setting*

The efficiency-based approach toward priority-setting suffers from institutional vagueness.[56] The notion that uneven dollars per lives saved indicates a systemic problem with priority-setting sounds plausible on the surface, but appears quite misguided if one considers institutional context.[57]

Advocates relying on the regulatory reform tables act as if all resources in the world are fungible.[58] Anytime a government agency spends "too much" on one environmental problem, argue some of these reformers, it kills people by foregoing an opportunity to spend that money on a cheaper life-saving intervention.[59] But most government regulation does not spend government money to remedy environmental problems; rather, it establishes rules that effectively require polluters to spend money cleaning up the messes they have created.[60] This very simple fact has enormous consequences. It means that the private money saved from foregoing an expensive regulation will usually not be spent on other health and safety priorities—unless the government is willing to tax the polluting industry and use the money thus raised for some better life-saving purpose.[61]

A responsible debate about improving priority-setting would distinguish debates about how to expend government monies from debates about the stringency of government regulation, which does not

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[54] *See* Driesen, *supra* note 1, at 6–12.

[55] *See id.* at 15–31.

[56] *See* Driesen, *supra* note 6, at 10,012–13, 10,017.

[57] *Id.* at 10,013, 10,017–18.

[58] *See id.* at 10,017 (citing Breyer, *supra* note 2, at 12–18).

[59] *See* Ackerman & Heinzerling, *supra* note 18, at 53–55 (describing the theory of statistical murder regulatory reformers employ).

[60] *See, e.g.*, Clean Air Act, 42 U.S.C. §§ 7411, 7412 (2000).

[61] *See* Driesen, *supra* note 6, at 10,016.

spend public money.[62] We can legitimately require chemical plants to clean up their pollution.[63] It is not so clear that institutional and legal restraints allow us to require chemical plants to fund unrelated life-saving interests, like improved automobile safety or childhood vaccinations that regulatory reformers sometimes suggest receive too little attention.[64]

Economic dynamic theory's concern with the pace of government regulation calls attention to another important element in the priority-setting debate.[65] While better priority-setting is always desirable, exercises in priority-setting must be limited. Otherwise, we will have endless debates about priority-setting in lieu of any significant accomplishments.[66] Government has a pronounced tendency to debate priorities in lieu of action, since debates offer opportunities for involvement and analysis, whereas action generates political controversy that can harm government officials.[67] These sorts of institutional considerations have figured prominently in the design of laws governing priority-setting at administrative agencies, as they should.[68] Thus, for example, Congress has exempted administrative decisions about whom to regulate first from judicial review under several statutory provisions, set strict deadlines, and employed sensible, but fairly open-ended, criteria for these crucial priority-setting decisions.[69] This represents a sound response to the economic dynamic problems of regulation.

B. *Cost-Benefit Analysis*

Proponents of allocative efficiency tend to advocate increased reliance upon cost-benefit analysis as the means of choosing goals for specific environmental regulations.[70] These proposals have met with some skepticism regarding both the theory and practice of measuring

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[62] *See generally id.* at 10,010–13.

[63] *See id.* at 10,017.

[64] *See id.* at 10,015–16 (citing BREYER, *supra* note 2, at 19, 67).

[65] DRIESEN, *supra* note 1, at 12 (noting the "slow and uncertain" pace of government decisionmaking).

[66] Driesen, *supra* note 6, at 10,019.

[67] *See generally* DRIESEN, *supra* note 1, at 12.

[68] *See* Driesen, *supra* note 6, at 10,006 (discussing exemptions of ordering decisions from litigation and precautionary approach to agency agenda setting, both of which avoid paralysis in priority setting preceding regulation).

[69] *Id.*

[70] DRIESEN, *supra* note 1, at 17 (explaining that CBA helps to determine regulations' goals).

the environmental benefits of regulations.[71] Economic dynamic theory raises some questions about estimates of costs as well, and about the lack of correspondence between optimal regulation and optimal pollution levels.

1. Compliance Costs

A regulated party will incur compliance costs after an agency promulgates a regulation, usually several years later. Studies comparing regulatory cost estimates with actual compliance costs show that regulators almost always overestimate costs.[72] This matters a lot, because the regulator pursuing optimal regulatory levels would purchase more emission reductions if the costs were lower.

Economic dynamics help explain why this occurs so regularly. Even if an agency perfectly estimated the control cost a regulation would generate prior to promulgation, the very act of enacting the regulation lowers the cost. The pre-promulgation cost estimates represent guesses based on a less-robust market than will exist after an agency promulgates a regulation. Once an agency enacts a rule, regulated companies will expect their managers to find the cheapest possible way of complying in a competitive market. If they use the technologies contemplated at the time of promulgation, they will seek the lowest possible prices through competitive bidding. Furthermore, if they can find a cheaper method of meeting the regulatory target, they will use it. Hence, the equilibrium a cost-benefit criterion tries so hard to capture disappears upon promulgation of a regulation, because of the economic dynamic involved.

The regulatory process creates some economic dynamics that hinder the development of accurate information about costs, even if they were predictable. Regulators rely heavily upon regulated industry for estimates of control costs.[73] Regulated industry has an incentive to exaggerate control costs in order to persuade the regulator to adopt less stringent regulation. CBA would tend to exacerbate this problem by giving erroneous cost estimates greater weight in decisionmaking.

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[71] *See id.* at 21 (discussing the difficulty of quantifying environmental risks for CBA).

[72] THOMAS O. MCGARITY, REINVENTING RATIONALITY: THE ROLE OF REGULATORY ANALYSIS IN THE FEDERAL BUREAUCRACY 131 (1996); Winston Harrington, et al., *On the Accuracy of Regulatory Cost Estimates*, 19 J. POL'Y ANALYSIS & MGMT. 297 (2000); Thomas O. McGarity & Ruth Ruttenberg, *Counting the Cost of Health, Safety, and Environmental Regulation*, 80 TEX. L. REV. 1997 (2002).

[73] MCGARITY, *supra* note 72, at 131–32.

2. Optimal Regulation as the Enemy of Optimal Pollution Levels

One cost-benefit criterion, that the cost of each regulation should equal its benefits, leads to sub-optimal societal pollution levels. Environmental law typically addresses an individual pollution problem, such as urban smog, through a series of regulations demanding reductions from multiple pollution sources, because most negative environmental and health effects come from the combined impact of numerous pollution sources. An allocatively "efficient" regulatory system will not produce "optimal pollution" if it fails to address all pollution sources. The combination of a cost-benefit balanced group of regulated pollution sources and a group of sources emitting pollution that have no control costs will produce less than the optimal amount of pollution.[74] Today's statutes still leave a number of significant pollution sources, such as non-point water pollution sources, mostly unregulated. So this disjunction between optimal regulation and optimal societal pollution levels is a serious problem, even for those committed to efficiency goals.

Economic dynamic analysis—in other words, an analysis that looks at issues affecting the total number of regulatory decisions over time, not just the efficiency of each decision—shows that CBA will increase the number of unregulated pollution sources, thus exacerbating the problem. CBA has generated paralyzing transaction costs. CBA requires an extremely comprehensive and difficult analytical effort that takes enormous resources and saps agencies' abilities to comprehensively address environmental problems, which stem from numerous sources, including cumulatively significant, but small and difficult to regulate, sources. Pollution continues unabated during the compilation of a CBA, judicial review of CBA, and remand of unsatisfactory analysis.[75] Remands may be very common, because non-arbitrary CBA is so difficult.[76] Even if the outcome of the analysis is a perfectly efficient decision, the continuation of pollution from unregulated sources that agencies never reach because of the analytic effort may well defeat efforts to have the "optimum" amount of pollution.

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[74] Barbara White, *Coase and the Courts*, 72 IOWA L. REV. 577 (1987).

[75] DRIESEN, *supra* note 1, at 27.

[76] *Id.*

B. *Emissions Trading*

Efficiency-minded economists have tended to recommend emissions trading or taxes as instruments of environmental protection.[77] Since emissions trading has received the most emphasis in practice, this Part will focus on how an economic dynamic perspective changes analysis of emissions trading.

From an economic dynamic perspective the question of which instrument provides the lowest short-term costs is not particularly important. Rather, the question becomes which instrument provides the most incentive for innovation that can increase our capabilities to address environmental threats over time.[78]

The traditional approach tends to assume an identity between encouraging efficiency and encouraging worthwhile innovation through the concept of dynamic efficiency.[79] But the suggestion that short-term cost effectiveness and desirable innovation coincide ignores both salient economic theory—namely the induced innovation hypothesis—and precise analysis of relevant incentives.[80]

The induced innovation hypothesis suggests that innovation occurs when the cost of conventional approaches rises, and conversely that little innovation will occur when the cost of conventional approaches fall.[81] Emissions trading reduces the cost of employing conventional approaches, which would suggest that it would lessen incentives to innovate.[82]

One can see this most easily in the case of high-cost innovation. Emissions trading will not cause coal-fired power plants to shut down in favor of renewable energy sources or car manufacturers to introduce hydrogen-based fuel cells. Emissions trading facilitates selection of the cheapest short-term response to regulatory demand, not the most environmentally advantageous and adaptively efficient alternatives for the long term.[83] This matters, because investment in high-

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[77] *See* Hahn & Stavins, *supra* note 30.

[78] *See* DRIESEN, *supra* note 1, at 75.

[79] *Id.* at 65.

[80] David M. Driesen, *Does Emissions Trading Encourage Innovation?*, [2003] 33 Envtl. L. Rep. (Envtl. L. Inst.) 10,094, 10,097–98 (Jan., 2003).

[81] *See id.*; Richard G. Newell et al., *The Induced Innovation Hypothesis and Energy-Saving Technological Change*, 114 Q.J. ECON. 941 (1999).

[82] *See* Driesen, *supra* note 80, at 10,097–98.

[83] *See* David M. Driesen, *Free Lunch or Cheap Fix?: The Emissions Trading Idea and the Climate Change Convention*, 26 B.C. ENVTL. AFF. L. REV. 1, 44 (1998) (discussing this point's implications for environmental benefit trading under the climate change regime).

cost options can lower costs over time.[84] High costs often prove temporary under conditions of change.[85]

Traditional regulation mandates emission reductions from specific pollution sources.[86] Does the spatial flexibility emissions trading offers provide superior incentives for innovation in general?

The trading mechanism creates an economic incentive for polluters facing high marginal control costs to *increase* emissions above the otherwise applicable limit, at least to the extent that the high-cost polluters plan to purchase relatively cheap credits from other sources.[87] It also creates an incentive for polluters facing low marginal control costs to *decrease* emissions, at least to the extent the polluter plans to sell credits to sources with high costs.[88] If the market functions smoothly, then trading occurs, the incentives cancel each other out, and the net economic incentive generally mirrors that of a comparable traditional regulation.[89]

Because a well-designed trading program may induce pollution sources with low marginal control costs to go beyond regulatory limits to a greater degree than they would under a traditional regulation, commentators focusing only on the low-cost sources have argued that emissions trading creates greater incentives for technological innovation than traditional regulation.[90] As some economists have realized, this argument ignores the incentive for high-cost sources to avoid pollution reduction activities.[91] Trading reduces the incentive for high-cost sources to apply new technology.

In theory, emissions trading probably weakens net incentives for innovation.[92]

> If a regulation allows facilities to use trading to meet standards, the low-cost facilities tend to provide more of the total reductions than they would provide under a comparable tra-

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[84] *See* DRIESEN, *supra* note 1, at 83–85.

[85] Driesen, *supra* note 80, at 10,097–98.

[86] *See, e.g.*, 42 U.S.C. § 7411 (2000) (Clean Air Act provisions regulating performance standards for new sources); 33 U.S.C. § 1316 (Clean Water Act provisions regulating performance standards for new sources).

[87] Hahn & Stavins, *supra* note 30, at 13.

[88] *Id.*

[89] *See* DRIESEN, *supra* note 1, at 64.

[90] *See* Hahn & Stavins, *supra* note 30, at 13.

[91] DAVID WALLACE, ENVIRONMENTAL POLICY AND INDUSTRIAL INNOVATION: STRATEGIES IN EUROPE, THE U.S. AND JAPAN 20 (1995); David A Malueg, *Emissions Credit Trading and the Incentive to Adopt New Pollution Abatement Technology*, 16 J. ENVTL. ECON. & MGMT. 52 (1987).

[92] Driesen, *supra* note 80, at 10,097–98.

ditional regulation. Conversely, the high-cost facilities will provide less of the total required reductions than they would have under a comparable traditional regulation. The low-cost facilities probably have a greater ability to provide reductions without substantial innovation than high-cost facilities. A high-cost facility may need to innovate to escape the high costs of routine compliance; the low-cost facility does not have this same motivation. Hence, emissions trading, by shifting reductions from high-cost to low-cost facilities, may lessen the incentives for innovation.[93]

IV. Toward Economic Dynamic Reform

Economic dynamic analysis focuses upon the need for environmentally friendly innovation to occur quite regularly to keep up with growing environmental problems associated with rising population and consumption.[94] It uses the free market as a model, not of perfect efficiency—which it does not possess—but of how to encourage innovation—which the free market does well when competition is robust. The problem, of course, is that the free market does not encourage innovation protecting the environment very well, except in those cases where environmental protection happily coincides with reduced cost, and not always then.[95] When environmental innovation would produce fabulously valuable environmental improvements, even nominal costs can discourage realization of these improvements.[96] Because of this, government must produce a regulatory, stimulus-driving innovation that works something like consumer demand does in free markets. But economic dynamic analysis reveals that impediments exist to government playing this role well.[97] Recognition of the nature of these impediments creates a new set of questions for environmental policy making and law to focus upon.

A. *Privatization*

Free markets tend to produce demand for innovation, because consumers offer decentralized and flexible sources of demand and op-

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[93] Driesen, *supra* note 32, at 335.

[94] *See* Driesen, *supra* note 1, at 9–10.

[95] *See id.* at 98.

[96] *See id.*

[97] *See id.* at 112–19.

portunity. Government, by contrast, tends toward slow and plodding environmental protection enacted through painstaking rulemaking proceedings.[98] This naturally invites the question of whether privatization can allow government to escape its tendency to fall behind the curve of private decisions increasing pollution.[99]

This suggestion will strike those enamored of government solutions as a bad idea. But we already have some environmentally beneficial forms of privatization in environmental law.[100] The citizen suit has privatized some enforcement of environmental law and thereby increased the vigor of enforcement.[101] Likewise, "right-to-know" requirements have encouraged voluntary private pollution reduction.[102]

We can design more dynamic economic incentives that encourage competition to reduce pollution, much as the free market creates competition to provide better amenities. This requires creation of mechanisms that circumvent the need for repeated government decisions and allow private actions, rather than government decisions, to stimulate reductions in pollution.

The law can apply to polluters either positive economic incentives, such as revenue increases or cost decreases, or negative economic incentives, such as revenue decreases or cost increases. This reveals a possibility that has received too little attention. Negative economic incentives can fund positive economic incentives.

Governments have already employed this strategy. New Zealand addressed the depletion of its fisheries by imposing fees on fishing, a negative economic incentive, and using revenue from these fees to pay some fishermen to retire, a positive economic incentive.[103] This may reduce pressure on the fish if fees are high enough. The California legislature has considered a program, Drive +, that imposes a fee upon consumers purchasing an energy-inefficient or high-pollution vehicle.[104] The proceeds fund a rebate on the purchase of an energy-

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[98] *Id.*

[99] *See id.* at 139–61 (considering this question at greater length).

[100] DRIESEN, *supra* note 1, at 140–41.

[101] *See id.* at 140–45 (discussing citizen suit's value as a source of vigor and suggesting ways to enhance that value).

[102] *See id.* at 146; Bradley C. Karkkainen, *Information as Environmental Regulation: TRI and Performance Benchmarking, Precursors to a Paradigm*, 89 GEO. L.J. 257, 297 (2001).

[103] T.H. Tietenberg, *Using Economic Incentives to Maintain Our Environment*, 33 CHALLENGE 42 (1990).

[104] Nathanael Greene & Vanessa Ward, *Getting the Sticker Price Right: Incentives for Cleaner, More Efficient Vehicles*, 12 PACE ENVTL. L. REV. 91, 94–95 (1994).

efficient vehicle or low-polluting vehicle.[105] Similarly, New Hampshire officials have proposed an "Industry Average Performance System" that redistributes pollution taxes to the polluting industry in ways that favor lower emissions.

One can build on this principle of having negative economic incentives fund positive economic incentives to craft laws that mimic the free market's dynamic competitive character far better than taxes or subsidies. In a competitive free market, a firm that innovates to reduce its cost or increase its revenues not only increases its profits, it often reduces its competitors' profits. Hence, firms in a very competitive market face strong incentives to innovate and improve. Failing to innovate and improve can threaten their survival. Implementing innovations and improvements can help firms prosper in a competitive market. One might seek to design environmental law to create a similar dynamic.

One could craft, for example, an "environmental competition law" requiring polluters with relatively high pollution levels to pay any costs that competitors incur in realizing lower pollution levels plus a substantial premium, thereby creating a significant incentive to be among the first to eliminate or drastically reduce targeted pollutants.[106] Such a law would simply authorize any polluter to collect costs plus a premium from any competing firm with higher pollution levels. Thus, for example, a power plant that switched fuels to achieve a lower emissions rate per kilowatt-hour than its competitors might collect the cost of the fuel switching from its coal-burning competitor, plus a premium.

An environmental competition law directly attacks a fundamental problem with existing free market incentives: the polluting firm must absorb any cleanup costs. Because the firm does not experience all of the costs of pollution itself—most are externalized and felt by the general public—it rarely pays to clean up. If firms could systematically externalize the costs of cleanup without substantial administrative intervention, just as they externalize the cost of pollution, then even a fairly modest premium might create adequate incentives to control pollution.

This solves another problem as well. The free market system provides no systematic incentive for environmentally superior perform-

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[105] *Id.*

[106] *See* DRIESEN, *supra* note 1, at 153–61 (discussing this idea in some detail).

ance. The environmental competition statute regularly rewards superior environmental performance.

An environmental competition statute would create a private environmental law, with a few public decisions setting up the law, but substantial enforcement by low-polluting businesses against competitors. The law would create a private right of action that allows a business that realizes environmental improvements through investment in pollution-reducing or low-pollution processes, control devices, products, or services to secure reimbursement for expenses, plus some premium from more polluting competitors. Hence, the scheme would create economic incentives for some companies to become enforcers of the law, rather than creating incentives for most companies to resist enforcement. This would effectively privatize enforcement, making it a private activity, rather than a government activity with some public-spirited private support, as in the citizen suit mechanism.

Such a proposal overcomes the fundamental problem with traditional regulation, emissions trading, and pollution taxes. These mechanisms rely on government decisions as the driver for pollution reductions. An environmental competition law makes private initiative, motivated by the prospect of gain and the fear of loss, the driver of environmental improvement, thus replicating free market dynamics. The magnitude of the incentive may depend upon the extent of industry fears about competitors' achievements, rather than only the limited cost government imposes through regulation or pollution taxes.

Whether or not one accepts the value of this particular idea, it should demonstrate the value of taking on the plodding nature of government as a problem to be overcome by reliance on the model provided by the economic dynamics of the free market. Once we move beyond policy prescriptions rooted in efficiency-based analysis, new possibilities emerge.

B. *More Fair and Effective Regulation*

Combining analysis of the practical economic dynamic resulting from opportunities to profit systematically from the conversion of natural resources to products for consumption, with the insights of public choice theory, explains some important features of the regulatory system that receive insufficient attention. Each of us finances the thwarting of environmental regulation through our gas and utility payments. These payments pay for an army of environmental lawyers, scientists,

and economists that work hard to prevent enactment and effective enforcement of environmental regulation.[107] This makes environmental regulation less adaptively efficient than it might be, produces inordinate delay, and at times, the gutting of environmental laws.[108]

Yet, efficiency-based analysis pays little attention to this problem. Once one focuses on this as a problem, many potential solutions suggest themselves.[109] Public participation currently rests on the principle of open participation; all can participate as much as they want.[110] This approach advantages those with the most capacity to participate—namely, those who can hire professionals in great numbers to represent them, like existing dirty industries—not the public seeking relief from environmental problems or environmental entrepreneurs hoping to create new markets for environmental innovations.[111]

We should at least think about a system of equal participation.[112] In such a system, those who wish to hire professionals to represent their interests would have to hire professionals for their opposition. A less-radical reform might involve devoting more taxpayer money to technical assistance to communities hoping to benefit from environmental regulations and companies with promising new technologies to participate more actively.

Again, my point is not to strongly advocate any particular solution to existing inequities in regulatory process, but rather to suggest that economic dynamic analysis identifies the existence of these inequities as problems to be solved. And this problem has received insufficient attention, because of a myopic focus upon the static efficiency of each regulation viewed as a transaction.

C. *Improved Regulatory Design to Stimulate Change*

The issue of regulatory design has received amazingly little attention. Part of this failure to think about this important issue comes from the simplistic preoccupation with the project of bashing "command and control" regulation and promoting emissions trading. But design may matter as much or more to the economic dynamics of regulation than the choice between traditional regulation and emis-

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[107] DRIESEN, *supra* note 1, at 114.

[108] *See generally id.* at 115–16 (describing some of the forces creating this situation).

[109] *See id.* at 163–81 (reviewing a variety of possible proposals to make environmental regulation more fair and effective).

[110] *See id.* at 167.

[111] *See id.* at 169–70.

[112] *See id.* at 170–76 (discussing a number of ways of equalizing participation).

sions trading. This should not be surprising. Emissions trading combines a traditional regulation limiting emissions with an authorization to trade. While the trading may enhance regulation's cost savings, the design of the regulatory limits that motivate the trading will influence a trading program, just as design influences a program that does not authorize trading.[113]

Many regulations, including both traditional regulation and state emissions trading programs, limit emission rates.[114] Emission rates limit the amount of pollution per unit of activity. For example, many regulations limiting air pollution coming from applications of paints, coatings, and solvents limit the pounds of emissions per gallon of substance used. EPA has traditionally regulated electric utilities through limits on the pounds of pollution per million British Thermal Units (BTUs), which measure energy use.[115]

The federal acid rain program and the federal regulations implementing the phase-out of ozone-depleting substances, however, limit the total mass of permitted pollution.[116] In other words, the ozone-depletion regulations limit the tons of such substances produced each year. The acid rain program limits tons of sulfur dioxide emitted per year.

This distinction between mass-based and rate-based limits matters a lot to the effectiveness of regulation and its economic dynamic. A rate-based regulation does not limit the mass of pollution that a pollution source may discharge. If a company's activity level increases, so will its pollution. On the other hand, a mass-based regulation limits the actual quantity of pollution allowed. If a company wishes to increase its production, it must reduce its emissions rate so as to meet the mass-based requirement.[117]

This means that mass-based limits provide a built-in economic dynamic that rate-based limits lack. A company wishing to produce more of a product to meet rising demand must find ways to obtain

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[113] DRIESEN, *supra* note 1, at 193.

[114] *See, e.g.*, Natural Res. Def. Council v. Envtl. Prot. Agency, No. 90–2447, 1991 WL 157261 (4th Cir. Aug. 19, 1991); United States v. Allsteel, No. 87 C 4638, 1989 WL 103405 (N.D. Ill. Aug. 30, 1989) (unpublished disposition); United States v. Alcan Foil Products, 694 F. Supp. 1280, 1281 (W.D. Ky. 1988), *aff'd in part, rev'd in part*, 889 F.2d 1513 (6th Cir. 1989).

[115] Byron Swift, *Command Without Control: Why Cap-and-Trade Should Replace Rate Standards for Regional Pollutants*, [2001] 31 Envtl. L. Rep. (Envtl. L. Inst.) 10,330, 10,331 (Mar., 2001).

[116] DRIESEN, *supra* note 1, at 194–95.

[117] *Id.* at 195.

high cost. Stringent regulation has brought about the elimination of lead from gasoline, the sale of substitutes for ozone depleting substances, the removal of some regulated toxic chemicals from some occupational settings, and other rather significant changes. By limiting opportunities to use standard technologies, stringent regulation encourages innovation. Analysts regularly confuse opportunities for a wide range of technological responses—such as those provided by the absence of an environmental regulation—with a substantial incentive to provide environmental innovation.[127]

Conclusion

In general, economic dynamic analysis raises the issue of how to improve the economic dynamics of environmental law. Consideration of this issue leads to a sharply different set of questions than those currently dominating the field. These include the question of whether privatization is appropriate, of how to make administrative procedure more fair and effective, and of how to improve regulatory design. Focusing the policy debate upon these questions would constitute a significant and worthwhile change.

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[127] *Id.*