TRADABLE ENVIRONMENTAL ALLOWANCES: PROPERTY, NON-PROPERTY, OR QUASI-PROPERTY?

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ABSTRACT

Governments increasingly rely on tradable environmental allowances ("TEAs") to pursue various environmental objectives including reducing emissions, managing fisheries, regulating grazing areas, and preserving habitat. A number of environmental economists have argued that it is socially desirable for governments to recognize TEAs as property rights. By contrast, most public policymakers assert that TEAs should be treated as authorizations to emit that, like pollution permits under the Clean Air Act, would be freely revocable. I contend neither approach is optimal.

Using a cost-benefit framework, I compare full property protection and no property protection both to each other and to an alternative based on "quasi-property." With quasi-property protection, the government establishes the optimal rate at which TEAs will decrease and just compensation is paid but only for unexpected, not expected, reductions. I conclude that, regardless of the government's information, quasi-protection is unambiguously superior to full protection because it eliminates the social costs of just compensation when just compensation is unnecessary. However, the relationship between quasi-protection and no protection is less clear. With perfect information, the two rules are functionally equivalent. But with imperfect information, the relationship is ambiguous: if uncertainty costs exceed compensation costs, quasi-protection is superior; if compensation costs exceed uncertainty costs, no protection is superior.

To resolve this ambiguity, I suggest that the government permit an election of rules and, for TEA owners electing quasi-protection, mandate an innovative solution: require the owners to reimburse the government for the social costs of just compensation. By requiring TEA owners to internalize these external costs, the government is able to align owners' private incentives with the optimal social outcome. After discussing three potential objections regarding the use of quasi-property protection for TEAs, I examine the broader implications of this issue by exploring a puzzle that has been overlooked in the just compensation literature: namely, why owners of certain entitlements, including land, chattels, and intellectual property, are typically entitled to compensation for confiscation, while owners of other entitlements, including tradable environmental allowances, are usually not entitled to such compensation, and whether there is any functional justification for this distinction.

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I. INTRODUCTION

Proponents of emissions trading typically confront two sets of adversaries: supporters of "command-and-control" regulation and advocates of corrective taxes. A number of theoretical, as well as empirical, studies suggest that trading is often more cost-effective than regulation.[1] Moreover, while disagreements persist over whether trading or taxes is superior for addressing pollution externalities,[2] recent proposals tend to recommend trading, as many consider taxes to be politically unpalatable.[3] Yet, implementing effective trading systems or, for that matter, determining whether in practice such trading systems are superior to corrective taxes, requires a well-developed understanding of their institutional design.[4] Fortunately, there is a burgeoning literature that seeks to examine a number of critical design issues including whether to allocate allowances via grandfathering or auctioning, how to estimate, as well as mitigate, the problem of leakage, and when to permit banking, borrowing, or perhaps both.[5]

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[1] *See generally* T.H. TIETENBERG, EMISSIONS TRADING: PRINCIPLES AND PRACTICE (2006); DANIEL H. COLE, POLLUTION AND PROPERTY: COMPARING OWNERSHIP INSTITUTIONS FOR ENVIRONMENTAL PROTECTION (2002); *see also* Douglas A. Kysar, *Law, Environment, and Vision*, 97 NW. U. L. REV. 675, 675-76 (2003) (noting that "scholars have labeled tradable permits 'the most fashionable innovation in environmental policy today,' promising . . . to achieve regulatory goals with less cost than traditional command-and-control techniques" (quoting Lisa Heinzerling, *Selling Pollution, Forcing Democracy*, 14 STAN. ENVTL. L.J. 300, 301 (1995))).

[2] *Compare* William J. BAUMOL & WALLACE E. OATES, THE THEORY OF ENVIRONMENTAL POLICY 73-74 (1988) (discussing Martin L. Weitzman, *Prices v. Quantities*, 41 REV. ECON. STUD. 477, 487 (1974)), *with* Louis Kaplow & Steven Shavell, *On the Superiority of Corrective Taxes to Quantity Regulation*, 4 AM. L. ECON. REV. 1 (2002) (responding to both Weitzman and Baumol and Oates).

[3] *See* Inho Choi, *Global Climate Change and the Use of Economic Approaches: The Ideal Design Features of Domestic Greenhouse Gas Emissions Trading with an Analysis of the European Union's CO_2 Emissions Trading Directive and the Climate Stewardship Act*, 45 NAT. RESOURCES J. 865, 865-66 (2005) (contending that "it is unlikely that a carbon tax will be politically acceptable in the United States despite the tax's theoretical appeal"); Barton H. Thompson, Jr., Forward, *The Search For Regulatory Alternatives*, 15 STAN. ENVTL. L.J. vii, xix (1996) (pointing out that, while direct incentives such as taxes may be "more dynamic than marketable permit systems," they are "politically less feasible"); *cf.* J.R. DeShazo & Jody Freeman, *Timing and Form of Federal Regulation: The Case of Climate Change*, 155 U. PA. L. REV. 1499, 1544-45 (2007) (arguing that "stronger industry consensus [will] emerge in favor of cap-and-trade").

[4] *See* Jody Freeman & Daniel A. Farber, *Modular Environmental Regulation*, 54 DUKE L.J. 795, 836 (2005) (pointing out that, "regardless of the tool chosen, it seems increasingly clear that careful attention to design on the front end and monitoring on the back end will both be crucial" (citing MOVING TO MARKETS IN ENVIRONMENTAL REGULATION, LESSONS FROM TWENTY YEARS OF EXPERIENCE (Jody Freeman & Charles D. Kolstad eds., 2006).

[5] *See, e.g.*, Ian Mackenzie et al., *The Optimal Initial Allocation of Pollution Permits: A Relative Performance Approach*, 39 ENVTL. & RES. ECON. 265 (2008) (allocation); Brian C. Murray et al.,

Yet one fundamental question has been neither fully resolved nor systematically analyzed: the optimal legal status of tradable environmental allowances (or "TEAs").[6] The conventional wisdom among economists is that TEAs should be treated as property rights and granted full property protection.[7] According to this argument, full protection reduces uncertainty for participants and decreases the likelihood that the market will unravel.[8] By contrast, most public policymakers and government officials are just as adamant that TEAs should not be treated as property rights. Doing so, they assert, would eliminate the flexibility that regulators need to adjust to changing circumstances.[9]

In this Article, I contend that, if the objective is to design an emissions trading system that maximizes social welfare, it is unlikely that either full property protection or no property protection is the optimal solution. Instead, I propose an alternative approach based on "quasi-property" protection. The structure of quasi-property is simple: policymakers can design TEAs to decrease at a predetermined rate and to a predetermined level that they believe, at the time of the initial allocation, to be optimal. Importantly, while *unexpected* reductions would be compensable, these *expected* reductions would not be compensable.

Estimating Leakage from Forest Carbon Sequestration Programs, 80 LAND ECON. 109 (2004) (leakage); Jonathan Rubin, *A Model of Intertemporal Emission Trading, Banking and Borrowing*, 31 J. ENVTL. ECON. & MGMT. 269 (1996) (banking and borrowing).

[6] Here, I use the acronym "TEAs" to refer primarily to "marketable pollution permits" although TEAs also have been utilized for, *inter alia*, managing fisheries, regulating grazing areas, and preserving habitat. *See* Katrina Wyman, *From Fur to Fish: Reconsidering the Evolution of Private Property*, 80 N.Y.U. L. REV. 117, 156 (2005) (noting these approaches "come out of the growing interest in property rights theory in economics in the 1960s"). During the 1990s, several commentators offered analyses of whether the confiscation of TEAs in the air pollution context might violate the Takings Clause of the Fifth Amendment. *See* Justin Savage, Note, *Confiscation of Emission Reduction Credits: The Case for Compensation Under the Takings Clause*, 16 VA. ENVTL. L.J. 227, 238 (1997); Susan A. Austin, Comment, *Tradable Emissions Programs: Implications Under the Takings Clause*, 26 ENVTL. L. 323 (1996); Yvonne F. Lindgren, Note, *The Emissions Trading Policy: Smoke on the Horizon fro Takings Clause Claimants*, 18 HASTINGS CONST. L. Q. 667 (1991). However, as the late Professor Henry Span pointed out, this doctrinal focus was "misguided" because "the important question is not whether the government is constitutionally bound to provide compensation, but whether government *should* constitutionally bind itself to provide compensation." Henry A. Span, Note, *Of TEAs and Takings: Compensation Guarantees for Confiscated Tradeable Environmental Allowances*, 109 YALE L. J. 1983, 1986 (2000). In analyzing this question, Professor Span argues that "public choice theory suggests that guarantees will lead to overprotection of TEA-holder interests more often than they will prevent underprotection." *Id.* at 1984. I address this public choice argument in Part IV.C, *infra*.

[7] *See* TIETENBERG, *supra* note 1, at 193 ("Economists have argued consistently that tradable permits should be treated as secure property rights to protect the incentive to invest in the resource.").

[8] *See id.* ("Confiscation of rights or simply insecure rights could undermine the entire process."); Lee Anne Fennell, *Revealing Options*, 118 HARV. L. REV. 1399, 1475-76 (2005) (pointing out that "tradable allowance markets cannot proceed efficiently unless participants believe that the government is unlikely to pull the entitlement without notice or compensation"); *cf.* Lawrence Blume & Daniel L. Rubinfeld, *Compensation for Takings: An Economic Analysis*, 72 CAL. L. REV. 569, 624 (1984) (concluding that "compensation can improve the efficiency of the land market by eliminating some or all of the risk of governmental regulation that risk-averse landowners face").

[9] *See* Span, *supra* note 6, at 2007 (pointing out that guaranteeing compensation for confiscated TEAs is "not costless" because "there is the possible loss in government flexibility"); Fennell, *supra* note 8, at 1476 (asserting that "the government clearly needs the power to adapt to changing circumstances").

The logic of quasi-property protection is also relatively straightforward. In emissions trading, the government typically reduces emissions levels incrementally. Because these incremental reductions are expected, the government should not be required to compensate TEA holders for such reductions. Requiring the government to do so would unnecessarily increase the administrative costs of just compensation. Yet, because of unanticipated changes in the marginal cost and marginal benefit of restricting an additional unit of emissions, the government may need to engage in additional TEA reductions. Because these additional reductions are unexpected, the government should be required to compensate TEA holders for such reductions. Requiring the government to do so decreases the uncertainty costs arising from the possibility of an uncompensated confiscation. In short, by relying on quasi-property protection, the government is able to combine the advantages of no property protection and the advantages of full property protection, thereby minimizing the sum of compensation costs and uncertainty costs.

In Part II, I examine the underlying legal framework of several trading systems and find that most enabling statutes, both inside and outside the United States, do not recognize TEAs as property rights. Despite this lack of protection, public officials are typically expected to refrain from confiscating allowances arbitrarily.[10] The result is, what one commentator has characterized as, an "uneasy compromise."[11]

In Part III, I compare three possible legal rules for TEA entitlements: full property protection, no property protection, and quasi-property protection. Regardless of the government's information, quasi-protection is superior to full protection because it eliminates unnecessary compensation costs. Although the relationship between quasi-protection and no protection is ambiguous, quasi-protection may be superior because the social costs of uncertainty could be higher than the social costs of compensation. However, any doubt can be resolved by permitting TEA holders to choose between no protection and a modified version of quasi-protection in which condemnees pay the social costs of compensation. By requiring TEA holders to internalize these external costs, the government is able to align TEA holders' private incentives with the optimal outcome.

In Part IV, I consider three potential counterarguments regarding the use of quasi-property protection for TEAs. First, I consider an alternative to TEAs in which the government relies on price controls, rather than quasi-protection, to reduce price uncertainty. I show that with either a price floor, a price ceiling, or both a price floor and price ceiling certain emitters will reduce their emissions even though they should have purchased TEAs while other emitters will purchase TEAs even though they should have reduced their emissions. I also demonstrate why attempting to "peg" the price of TEAs by adjusting the supply of TEAs will result in either too much pollution (if the

[10] *See* TIETENBERG, *supra* note 1, at 193 (noting that "although administrators are expected to refrain from arbitrarily confiscating rights, as sometimes happened with banked credits in the early U.S. Emissions Trading Program, they do not give up their ability to adopt a more stringent camp as the need arises"); *cf.* Fennell, *supra* note 8, at 1476 ("As a political matter, any efforts to simply extinguish the rights created through the permits will encounter strong resistance from those who have purchased them.").

[11] TIETENBERG, *supra* note 1, at 193.

government artificially increases the supply) or too little production (if the government artificially decreases the supply). Second, I evaluate another alternative to quasi-protection in which the government imposes time limitations on TEAs by staggering their expiration dates. I conclude that, if the government has any discretion in whether to retire expired TEAs or confiscate unexpired TEAs without compensation, staggering TEAs may entail more uncertainty than quasi-property. Third, I explore whether TEA holders actually need a guarantee of just compensation for unexpected reductions in light of the fact that these holders can, and often do, exert significant influence in the legislative and administrative process to prevent such reductions. I suggest that, as an empirical matter, relying exclusively on the lobbying efforts of these relatively concentrated interests is unlikely to alleviate, although it may mitigate, the problem of price uncertainty.

In Part V, I explore the broader implications of characterizing TEAs as property, non-property, or quasi-property, especially for debates about the purpose of just compensation. In recent years, a puzzle has developed that has largely gone unnoticed. Traditional tangible entitlements, like land (real estate) and chattels (personal property), that arose spontaneously are almost universally treated as property. By contrast, modern intangible entitlements, like intellectual property rights and tradable environmental allowances, that are deliberately created as an instrument of social policy are treated in different ways. Like land and chattels, intellectual property rights are usually defined as property and typically create an obligation to compensate, whereas tradable environmental allowances are often not characterized as property and normally do not create an obligation to compensate. The puzzle has positive as well as normative dimensions: (i) why are certain entitlements, but not others, characterized as property? and (ii) why should certain entitlements, but not others, be characterized a property?

In Part VI, I conclude by suggesting that, because of the potential advantages of quasi-property protection, various regional trading initiatives should experiment with different property rules for TEAs. For example, the four regions of the United States (Northeast, West, Midwest, and South), three of which have established, or are in the process of establishing, trading systems, could implement no protection, full protection, quasi-protection, and an election between no protection and quasi-protection, respectively. The outcome of such an experiment might provide some empirical evidence regarding the optimal legal rule, a rule that policymakers could then use as a template in designing future initiatives.

II. CURRENT STATUS OF TEAS

A number of environmental initiatives, from legislation to combat air pollution to regulations to manage fisheries, rely on TEAs. In this section, I briefly discuss four of these initiatives. The first two, the Sulfur Allowance Program of the Clean Air Act Amendments of 1990 and the Regional Clean Air Incentives Market, are domestic programs. The next two, the European Union Emission Trading Scheme and New Zealand's Individual Transferable Quotas, are non-domestic programs.

A. Domestic Examples

1. *Clean Air Act*

The Clean Air Act Amendments of 1990 (CAA Amendments) established, among other things, an allowance system to reduce sulfur dioxide (SO_2) emissions, a primary cause of acid rain.[12] The CAA Amendments define an allowance as "a limited authorization to emit sulfur dioxide in accordance with the provisions of this subchapter."[13] The CAA Amendments also explicitly state that such an allowance "does not constitute a property right."[14] They further indicate that "[n]othing in this subchapter or in any other provision of law shall be construed to limit the authority of the United States to terminate or limit such authorization."[15]

Based on this statutory language, commentators have pointed out that allowances authorized under the CAA Amendments are not entitled to any property rights protection.[16] One effect of this lack of property protection has been to lower the value and, correspondingly, the trading price of SO_2 allowances.[17] But the result of a suboptimal price is a possible inefficiency in the SO_2 emissions market.[18] If SO_2 emissions allowances are trading at the equilibrium price, then (assuming that policymakers have authorized the optimal number of TEAs) emitters will have the correct incentive in choosing whether to reduce their own emissions or to purchase allowances from others.[19] However, if the price of SO_2 allowances is lower than the equilibrium

[12] *See* JAMES SALZMAN & BARTON H. THOMPSON, JR., ENVIRONMENTAL LAW AND POLICY 105 (2d ed. 2007) ("Repealing the uniform requirement of scrubbers, the 1990 CAA Amendments instituted performance-based standards and the first national program of tradable emissions allowances. The program was designed to reduce SO_2 emissions by 10 million tons per year beginning in the year 2000, a more than a 50% reduction compared to 1990." (citing 42 U.S.C. § 7651)).

[13] 42 U.S.C. § 7651b(f) (Supp. III 1991).

[14] *Id.*

[15] *Id.*

[16] *See, e.g.*, Nash, *supra* note 10, at 370 & n.205; Fennell, *supra* note 8, at 1475; *see also* Tom Tietenberg, *Tradable Permits in Principle and Practice*, 14 PENN ST. ENVTL. L. REV. 251, 267 (2006) (noting that "administrators would not be required to pay compensation for withdrawing a portion of the authorization to emit as they would if allowances were accorded a full property right status").

[17] *See* Daniel H. Cole, *Clearing the Air: Four Propositions About Property Rights and Environmental Protection*, 10 DUKE ENVTL. L. & POL'Y F. 103, 115 (1999) ("The limitations on emission allowances under the Clean Air Act unquestionably lower the economic value of the allowances, as several commentators have noted." (citing 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, 116-17 (1989))).

[18] *See* Savage, *supra* note 6, at 235 n.79 (1997) (noting that "[t]he lack of a property interest in sulfur dioxide allowances probably precludes a healthy market for sulfur dioxide allowances from developing"); *cf.* Jeanne M. Dennis, Comment, *Smoke for Sale: Paradoxes and Problems of the Emissions Trading Program of the Clean Air Act Amendments of 1990*, 40 UCLA L. REV. 1101, 1118 (1993) ("The degree to which property interests exist in allowances will greatly affect Title IV's effectiveness in controlling acid rain. For an emission allowance market to develop, interests in allowances must be sufficiently protected to merit investment.").

[19] *See* SALZMAN & THOMPSON, JR., *supra* note 14, at 107 ("If the market operates efficiently, the greatest share of reductions will come from agents who can do so at the cheapest cost, allowing each polluter to weigh the marginal cost of abatement against the cost of buying credits and make an efficient individual decision.").

price, then certain emitters may choose to buy allowances even though it would have been more cost effective for these emitters to reduce their own emissions.

2. *RECLAIM*

Unlike the CAA, the Regional Clean Air Act Incentives Market (RECLAIM) is a state initiative, enacted in California through the South Coast Air Quality Management District (SCAQMD or the "District").[20] RECLAIM attempted to rely on a trading program to regulate a number of air-borne compounds, including both SO_2 and nitrogen oxides (NO_X), that utilities and firms were emitting in the Los Angeles area.[21] RECLAIM established a baseline level of pollution that these utilities and firms could emit on an annual basis.[22] The program's designers anticipated that the permissible level of emissions would decline in each successive year.[23] Indeed, RECLAIM included "an expectation that greater air pollution reduction [would] be necessary in the future."[24]

Like the CAA, allowances under RECLAIM are not considered property rights.[25] RECLAIM's authorizing regulations indicate that a RECLAIM Trading Credit (RTC) is a "limited authorization to emit RECLAIM pollutants."[26] These regulations also indicate that "[a]n RTC shall not constitute a security or other form of property."[27] Indeed, "[n]othing in the District rules shall be construed to limit the District's authority to condition, limit, suspend or terminate any RTCs or the authorization to emit which is represented by a Facility Permit."[28] These disclaimers were especially notable because, under a previous trading program, SCAQMD had substantially discounted emission credits that had been banked.[29]

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[20] *See* Lesley K. McAllister, *Beyond Playing "Banker": The Role of the Regulatory Agency in Emissions Trading*, 59 ADMIN. L. REV. 269, 287 (2007) ("The RECLAIM Program has not been as extensively commented upon and analyzed, but along with the Acid Rain Program, it is the longest-standing cap and trade program in the country.").

[21] *See* Dennis, *supra* note 20 at 1138; *see also* McAllister, *supra* note 22, at 288 ("The sources covered by the RECLAIM Program are more heterogeneous than those of the Acid Rain Program, including not only power plants, but also refineries, asphalt and cement producers, and a wide variety of industrial sources that emit as little as four tons of NO_x or SO_2 annually.").

[22] *See* Dennis, *supra* note 20, at 1138.

[23] *See id.*

[24] *Id.* at 1139.

[25] *See* Austin, *supra* note 6, at 328 ("Like the federal acid deposition statute, the RECLAIM regulations explicitly state that no property rights are created by the tradable emissions program.").

[26] SCAQMD Rule 2007(b)(1) (1993).

[27] *Id.* Rule 2007(b)(2)-(3).

[28] *Id.* Rule 2007(b)(4).

[29] *See* John P. Dwyer, *The Use of Market Incentives in Controlling Air Pollution: California's Marketable Permits Program*, 20 ECOLOGY L.Q. 103, 110 (1993) ("Districts commonly confiscate a percentage of banked reductions to fund a 'community' bank to achieve air quality standards. Most dramatically, in June 1990, the SCAQMD discounted most banked credits by eighty percent, thereby confirming industry's fears about regulators' confiscatory tendencies." (citations omitted)).

Almost immediately, the RECLAIM program was beset with a number of problems.[30] The program's initial shortcoming was that many regulated entities had "an excess number of RTCs because the initial allocation exceeded actual emissions rates."[31] Moreover, unlike the SO_2 Program, and contrary to expectations, the initial allocation of emissions was "not ratcheted down."[32] As a result, "most companies were allowed emissions levels that exceeded the levels that would have occurred under command-and-control."[33] Subsequently, problems with California's electricity deregulation program also affected the RECLAIM market and caused a sharp increase in RTC prices.[34]

B. Non-Domestic Programs

1. *EU ETS*

The Kyoto Protocol of 1997 permits signatories to meet their commitments to reduce greenhouse gases using four types of "flexible mechanisms" including emissions trading.[35] Many countries are considering implementing, or have already implemented, various trading initiatives to reduce emissions in a cost-effective manner. Yet the first major signatory to do so was the European Union which, in 2005, established the European Union Emissions Trading Scheme (EU ETS or ETS).[36] The EU ETS includes all member states of the European Union.[37] Initially, ETS issued over 320 million allowances for an estimated 8,900 installations; within a year-and-a-half, trading volume was approaching 100 million allowances per month.[38]

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[30] *See* McAllister, *supra* note 22, at 289 ("Despite many similarities in design, the RECLAIM Program has experienced significantly more problems achieving compliance than the Acid Rain Program.").

[31] TIETENBERG, *supra* note 1, at 12.

[32] *Id.* at 130.

[33] *Id.*

[34] *Id.* (citing Paul Joskow & Edward Kahn, *A Quantitative Analysis of Pricing Behavior in California's Wholesale Electricity Market During Summer 2000*, 23(4) ENERGY J. 1 (2002)); *see also* Karen Palmer & Dallas Burtraw, *The Environmental Impacts of Electricity Restructuring: Looking Back and Looking Forward*, 1 ENVT'L & ENERGY L. & POL'Y J. 171 (2005) (discussing "the relationship between restructured electricity markets and pollution allowance markets" in Southern California).

[35] *See generally* SALZMAN & THOMPSON, JR., *supra* note 14, at 130 ("The Protocol contains four trading mechanisms . . . that allow parties to meet their commitments jointly."); *see also* Jonathan Donehower, *Analyzing Carbon Emissions Trading: A Potential Cost Efficient Mechanism to Reduce Carbon Emissions*, 38 ENVTL. L. 177, 189 (2008) ("The four flexible mechanisms outlined in the Kyoto Protocol are 1) emissions trading, 2) the clean development mechanism, 3) joint implementation, and 4) joint fulfillment. The flexible mechanisms allow for nations to take cheaper reduction measures outside their country and also allow industries to purchase cheaper GHG emission reductions from other industrial sources.").

[36] *See* Tietenberg, *supra* note 1, at 16 ("The first phase, from 2005 through 2007, is considered to be a trial phase. The second phase coincides with the first Kyoto commitment period, beginning in 2008 and continuing through 2012. Subsequent negotiations will specify the details of future phases.").

[37] *See* Donehower, *supra* note 37, at 195; *see also* Tietenberg, *supra* note 1, at 16 (noting that the EU ETS "applies to 25 countries, including the 10 accession countries, most of which are former members of the Soviet bloc").

[38] *See id.*

Like RECLAIM, ETS was initially rather ineffective because officials authorized an excessive number of allowances.[39] However, unlike the CAA and RECLAIM, both of which explicitly provide that allowances are *not* entitled to property protection,[40] the ETS is silent on the legal nature of the entitlement. One of the original ETS directives simply defines an "allowance" as "an allowance to emit one tonne of carbon dioxide equivalent during a specified period, which shall be valid only for the purposes of meeting the requirements of this Directive and shall be transferable in accordance with the provisions of this Directive."[41] Because of its failure to address the issue directly, it is even possible, as one commentator has suggested, that allowances under the ETS might be considered property in certain European countries but not in others.[42]

2. *New Zealand's ITQs*

TEAs also have been utilized to protect a number of natural resources that otherwise might have been subject to overexploitation. For example, in the management of fisheries, a number of countries have relied on individual transferable quotas (ITQs) in attempting to ration the total allowable catch (TAC) in a cost-effective way.[43] One of the most well-known ITQ systems has been operating in New Zealand since the 1980s and has been the subject of significant scrutiny.[44]

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[39] *See id.* at 198 ("ETS failed to accurately set market caps at a level that is environmentally effective in spurring widespread emissions reductions and encouraging market stability."); *see also* Craig A. Hart, *The Clean Development Mechanism: Considerations for Investors and Policymakers*, 7 SUSTAINABLE DEV. L. & POL'Y 41 (2007) ("Over-allocation of emissions allowances has occurred in both the European Union and Eastern Europe. The announcement of the first verification of EU national emissions in May 2006 caused the . . . market price of EUAs to drop by over 67 percent because verified emissions were 41 million metric tonnes of CO_2 . . . lower than expected.").

[40] *See supra* Part II.A.1-2.

[41] Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 Establishing A Scheme for Greenhouse Gas Emission Allowance Trading Within the Community and Amending Council Directive 96/61/EC, Article 3(a), *available at* http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32003L0087:EN:NOT.

[42] *See* Hitomi Kimura, "Definition of Credits: Comparative Study Between Japan and EU," *available at* http://biogov.cpdr.ucl.ac.be/bioinstit/NEW%20N%20PAPERS/KIMURA%20HITOMI%20PAPER.pdf, *at* *9 (2006) ("Many European countries treat allowance[s] as 'property', but its definition is up to the domestic law in each country. For example, UK, Germany, Netherlands, and Norway define credits as 'property'. However, Sweden does not define credits as property . . . .").

[43] *See* James Salzman, *Creating Markets for Ecosystem Services: Notes from the Field*, 80 N.Y.U. L. REV. 870, 886 n.64 (2005) ("Individual transferable quotas, known as ITQs, have become a common management tool for fisheries in Canada, New Zealand, Iceland, and other countries." (citing Alison Rieser, *Prescriptions for the Commons: Environmental Scholarship and the Fishing Quotas Debate*, 23 HARV. ENVTL. L. REV. 393 (1999))).

[44] *See e.g.*, Tracy Yandle & Christopher M. Dewees, *Privatizing the Commons Twelve Years Later: Fishers' Experiences with New Zealand's Market-Based Fisheries Management*, *in* THE COMMONS IN THE NEW MILLENNIUM: CHALLENGES AND ADAPTATION (N. Dolsak & E. Ostrom eds., 2003); P. Major, *The Evolution of ITQs in New Zealand*, *in* INDIVIDUAL TRANSFERABLE QUOTAS IN THEORY AND PRACTICE (R. Arnason & H.H. Gissurarson eds, 1999); C.J. Batstone, & B.M.H. Sharp, *New Zealand's Quota Management System: The First Ten Years*, 23 MARINE POLICY 177 (1999); *cf.* R. Quentin Grafton et al., *Private Property and Economic Efficiency: A Study of a Common-Pool Resource*, 43 J.L. & ECON. 679 (2000) (analyzing property rights in halibut fishery in British Columbia).

Interestingly, unlike emissions allowances under the CAA Amendments, RECLAIM, and the EU ETS, New Zealand's ITQs are, in fact, considered property rights.[45] As one commentator has pointed out, New Zealand's system for governing ITQs is a "rare exception in that it allocates full property rights."[46] Yet, overall, New Zealand's ITQ system has been quite successful in preventing the depletion of various stocks of fish.[47] Some commentators have even suggested that the property-right status of the program's ITQs is one factor possibly contributing to the program's success.[48]

III. OPTIMAL STATUS OF TEAS

A. Theoretical Framework

In this section, I develop a basic framework for analyzing the optimal legal status of TEAs. First, I outline three possible legal rules for defining TEA entitlements: full property protection, no property protection, and quasi-property protection. Second, I discuss two primary considerations for determining the best rule: regulatory uncertainty and regulatory flexibility. Third, I identify one of the framework's most important

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[45] *See* Tietenberg, *supra* note 18, at 267 & n.64 (noting that New Zealand's ITQ system "grants full property rights in perpetuity" (citing NAT'L RESEARCH COUNCIL COMM. TO REVIEW INDIVIDUAL FISHING QUOTAS, SHARING THE FISH: TOWARD A NATIONAL POLICY ON FISHING QUOTAS (1999)). Countries provide varying levels of protection for ITQs. *See* Gary D. Libecap, *Open-Access Losses and Delay in the Assignment of Property Rights*, 50 ARIZ. L. REV. 379, 391 (2008) (pointing out that the "strength of the property right . . . varies across countries" and that, while "ITQs in the United States and Canada are clearly specified as being use privileges and not property rights, revocable without compensation," ITQs in "Iceland, New Zealand, and Australia, ITQs are considered to be more secure property rights").

[46] Elizabeth Burleson, *Multilateral Climate Change Mitigation*, 41 U.S.F. L. REV. 373, 388 n.112 (2007). Indeed, the trend in the United States, for fishing quotas, as well as emissions allowances, is "for the government to avoid binding itself by placing explicit anti-compensation disclaimers in the statutes creating TEA programs." Span, *supra* note 6, at 1993 (citing Clean Air Act Amendments of 1990, § 403, 42 U.S.C. § 7651b(f) (1994) and Sustainable Fisheries Act of 1996, 16 U.S.C. § 1853(d)(3) (Supp. IV 1998)).

[47] *See, e.g.*, Christopher M. Dewees, *Effects of Individual Quota Systems on New Zealand and British Columbia Fisheries*, 8 ECOL. APPLICATIONS S133 (1998) (conducting empirical investigation of ITQs in New Zealand and British Columbia and finding "(1) an end of the 'race for fish,' (2) industry participants' maximization of returns from quota holdings, and (3) strong influence of individual quota system design details on outcomes"). It is important to note as well that using ITQs, in New Zealand and elsewhere, also may have unintended consequences. *See* Katrina M. Wyman, *The Property Rights Challenge in Marine Fisheries*, 50 ARIZ. L. REV. 511, 537 (2008) ("Already there are indications that the ITQs that have benefited many wild fisheries also have had the unintended consequence of hindering the establishment of new and now more valuable uses of the oceans than wild fishing, such as marine reserves, aquaculture, and wind farms." (citing Mark T. Gibbs, *Lesser-known Consequences of Managing Marine Fisheries Using Individual Transferable Quotas*, 31 MARINE POL'Y 112, 113-16 (2007) (discussing New Zealand's ITQs))).

[48] *See, e.g.*, Ransom E. Davis, *Individually Transferable Quotas and the Magnuson Act: Creating Economic Efficiency in Our Nation's Fisheries*, 5 DICK. J. ENVTL. L. & POL'Y 267, 311-12 (1996) ("The New Zealand ITQ represents a valuable property right because it is fully transferable and divisible between fishers. . . . [The] ITQ system convincingly demonstrates that a fishery management regime that creates property rights in unharvested fish resolves the common resource dilemma and creates economic efficiency in fisheries."). *But cf.* Karol de Zwager Brown, *Truce in the Salmon War: Alternatives for the Pacific Salmon Treaty*, 74 WASH. L. REV. 605, 686 (1999) ("A well-designed ITQ system should not create property rights that could form the basis for a takings claim . . . .").

underlying assumptions: namely, that the optimal trading system will rely on incremental reductions to reach the appropriate emissions level.

1. *Three Legal Rules: Property, Non-Property, or Quasi-Property*

Traditionally, there have been two principal ways of delineating the legal status of TEAs: property (i.e., "full property protection" or "full protection") and non-property (i.e., "no property protection" or "no protection"). By "full property protection" I mean that TEAs are treated the same as other types of property rights such as a fee simple in land. Full protection entails not only market-alienability (i.e., that TEAs may be freely transferred for value) but also the expectation that any confiscation of the entitlement or reduction in the entitlement's value requires the government to pay "just compensation" (i.e., fair market value) to the entitlement holder. As discussed above, the treatment of ITQs in New Zealand is the equivalent of full property protection because regulators may not confiscate or limit allowances without paying compensation.[49]

By "no property protection" I mean that TEAs are treated only as limited authorizations to emit. Under no protection, TEAs still may possess some of the traditional attributes of property. For example, market participants can buy and sell TEAs. But the term "no protection" indicates that any government confiscation or reduction of TEAs does not require the payment of just compensation. As discussed above, the treatment of TEAs under the CAA Amendments, RECLAIM, and EU ETS (at least for certain EU members) is the equivalent of no protection because regulators in these programs may confiscate or limit allowances without paying compensation.[50]

There is, however, another alternative: quasi-property (i.e., "quasi-property protection" or "quasi-protection"). Quasi-protection differs from both full protection and no protection. With quasi-protection, the government would issue TEAs that, by definition, are automatically diminishing. For example, a single TEA entitlement may permit its owner to emit 1 unit of pollution in 2010, 0.6 units of pollution in 2030, and 0.2 units of pollution in 2050. TEAs would diminish at a rate and to a point that regulators believe, at the time of the initial allocation, to be optimal. TEA holders would not be entitled to compensation for reductions that are *expected*. Yet TEA holders would be entitled to compensation for any reductions that are *unexpected*.[51]

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[49] *See supra* Part II.B.2.

[50] *See supra* Part II.A.1-B.1.

[51] Because compensation is required for unexpected reductions, my use of the term "quasi-property" differs from Congress's use of "quasi-property" to describe SO_2 allowances under the CAA Amendments. *See* Nash, *supra* note 10, at 336 ("[T]he Congress that created sulfur dioxide emission allowances and statutorily purported to disclaim their property status nonetheless characterized the permits as 'quasi-property.'" (citing Henry E. Mazurek, Jr., *The Future of Clean Air: The Application of Futures Markets to Title IV of the 1990 Amendments to the Clean Air Act*, 13 TEMP. ENVTL. L. & TECH. J. 1, 11 (1994) ("[A] House Energy and Commerce Committee report issued during final debate over the [Clean Air] Amendments stated that allowances are like 'quasi-property,' and therefore can be reported as 'utility assets.'" (quoting H.R. Rep. No. 101-490, pt. 1, at 366 (1990)))); *see also* Carol M. Rose, *A Dozen Propositions on Private Property, Public Rights, and The New Takings Legislation*, 53 WASH. & LEE L. REV. 265, 297 (1996) (labeling SO_2 Program as "extremely valuable experiment in quasi-property rights").

Consider an example that illustrates the basic differences among the three rules. Suppose that Congress enacts legislation authorizing a national emissions trading system for carbon dioxide (CO_2). Congress knows there are currently five firms and that each firm emits 20 metric tons of CO_2. In 2010, the government auctions 100 TEAs, each of which permits its holder to discharge 1 metric ton of CO_2. At the auction, the five firms purchase twenty TEAs apiece. The government intends to reduce the total number of TEAs to 60 by 2030 and to 20 by 2050, and these planned reductions are common knowledge. Assume that trading occurs so that the fair market value of a TEA is known but that, at the end of 2030, each firm still has 20 TEAs.

If, as expected, the government reduces the number of allowances in 2030 by 40% (from 100 to 60) and thus confiscates 8 TEAs from each firm (20 – (20 x .40) = 8), what is the outcome under each legal rule? Under full property protection, the government would have to pay just compensation to each firm in the amount of the fair market value of the 8 allowances. Under no property protection, the government would not have to pay any compensation even though it confiscated 8 allowances from each firm. Under quasi-property protection, the government also would not have to pay any compensation because the confiscation of 8 allowances was an expected reduction.

If the government unexpectedly reduces the number of allowances in 2030 by 60% (from 100 to 40), rather than by 40% (from 100 to 60), and thus confiscates 12, rather than 8, TEAs from each firm (20 – (20 x .60)) = 12), the outcomes would be different. Under full protection, the government would still have to pay just compensation to each firm based on fair market value, and compensation would now be equal to the market value of 12 allowances. Under no protection, the government would not have to pay compensation to any firm, either for the 8 allowances the government expected to confiscate or for the additional 4 allowances it did not expect to confiscate. Under quasi-protection, the government would not have to pay compensation for the 8 allowances from the expected reduction, but the government would have to pay compensation for the additional 4 allowances that were confiscated unexpectedly.

Figure 1:
Degree of Property Protection and Just Compensation

	Compensation For Expected Reductions?	Compensation For Unexpected Reductions?
Full property protection	Yes	Yes
No property protection	No	No
Quasi-property protection	No	Yes

Thus, as Figure 1 indicates, full protection requires compensation for both expected and unexpected reductions; no protection does not require compensation for either expected or unexpected reductions, and quasi-protection would require compensation for unexpected, but not expected, reductions.

2. *The Tradeoff Between Regulatory Uncertainty and Flexibility*

In comparing these three rules, I focus on two sources of potential social costs. First, ceteris paribus, it is better for holders of TEAs to face less regulatory uncertainty rather than more regulatory uncertainty. Second, ceteris paribus, it is better for policymakers to have more regulatory flexibility rather than less regulatory flexibility. I briefly examine both of these factors in turn.

It is axiomatic among economists that a lack of property protection undermines the incentive to invest in a resource.[52] If a manufactured good could be confiscated immediately following its production or an intellectual property right copied immediately following its creation, there would be less of an incentive to invest in its production or its creation. Likewise, if a good that is being traded in the marketplace could be confiscated immediately after its purchase, there would be less of an incentive to purchase the good. In either case, the possibility of an uncompensated confiscation lowers the demand for the good and, as a result, the price of the good falls below the equilibrium price.

Similarly, the possibility of an uncompensated confiscation of TEAs is likely to undermine the incentive to invest in TEAs.[53] As an initial matter, emitters will have less of an incentive to create TEAs by reducing emissions below required levels. Many emissions trading systems permit polluters to reduce emissions below required levels and then either save the difference for a future period ("banking") or trade the difference to another polluter that needs additional allowances in the current period ("trading"). Reducing emissions below required levels is, of course, costly because such reductions require additional investments in abatement; nevertheless, parties may be willing to undertake these investments to either bank or trade additional allowances. However, the potential benefit of these additional reductions decreases as the likelihood of confiscation

[52] *See, e.g.*, Bruce L. Benson, *The Spontaneous Evolution of Cyber Law: Norms, Property Rights, Contracting, Dispute Resolution and Enforcement Without the State*, 1 J.L. ECON. & POL'Y 269, 281 n.14 (2005) (noting that the "incentives to invest in reputation or to count on future dealings are weak" if "property rights are insecure due to potentially arbitrary and/or opportunistic behavior by government"); William M. Landes & Richard A. Posner, *Indefinitely Renewable Copyright*, 70 U. CHI. L. REV. 471, 474-75 (2003) (pointing out that, "just as an absence of property rights in tangible property would lead to inefficiencies, so an absence of copyright protection for intangible works may lead to inefficiencies").

[53] Here, I use the term "confiscation" to refer broadly to governmental actions that may curtail TEAs including confiscation of allowances, changes in regulations, and termination of the program. *Cf.* Span, *supra* note 6, at 1990 ("Other possible regulatory changes that could be interpreted as curtailing TEAs include imposing additional regulations that make the TEAs less valuable and terminating the program altogether.").

increases. Thus, the possibility of confiscation means that emitters will have less of an incentive than they otherwise would have had to create such allowances.[54]

Moreover, emitters also will have less of an incentive to purchase existing TEAs. Most trading systems permit polluters to purchase allowances rather than reducing their own emissions. The purpose of trading is to allow those firms that are capable of reducing their emissions at lower cost to invest in additional abatement measures and to sell TEAS arising from these additional reductions to those firms for whom modifications would entail higher costs.[55] Yet the possibility of confiscation means that polluters will have less of an incentive to purchase TEAs: a polluter that otherwise would have preferred to purchase TEAs, rather than reduce its own emissions, may decide not to purchase these allowances because of the possibility of confiscation.[56]

If the government is able to confiscate TEAs without compensation, the demand for TEAs will decrease. As noted above, a decrease in the demand for any good, including TEAs, will artificially lower the trading price of that good. The problem is that, if the trading price of TEAs falls below the equilibrium price, firms that should take certain cost effective measures to reduce their emissions might fail to do so. Specifically, certain firms might fail to take measures whose costs are greater than the actual trading price of TEAs but less than the equilibrium price of TEAs. Therefore, uncertainty in the emissions trading system entails a positive social cost.[57] In addition, if holders or

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[54] *See* Span, *supra* note 6, at 2002 ("With ERC-type programs, the risk of confiscation without compensation will decrease the incentive to create ERCs through overcontrol. Why bother to make the investment in abatement technology or otherwise decrease one's level of pollution if the government can just step in and confiscate without compensation the fruit of one's labor, the ERCs? Guaranteed compensation for one's ERCs eliminates this disincentive to creating them."); Savage, *supra* note 6, at 228-29 (pointing out that confiscation might deter sources from creating ERCs) (citing Daniel P. Selmi, *Experimentation and the "New" Environmental Law*, 27 LOY. L.A. L. REV. 1061, 1066 (1994) ("Perhaps the most fundamental precondition for a properly functioning market to flourish is assurance that the regulatory system now and in the future will recognize the property rights that are created within the market.")).

[55] *See* Donehower, *supra* note 37, at 177-78 ("Ideally, emissions trading reduces the cost of meeting emissions obligations by placing a monetary value on GHG emissions and using the flexibility of the market to allow participants to decide whether it is cheaper to reduce emissions or to purchase excess allowances from others."); TIETENBERG, *supra* note 1, at 1 ("With emissions trading, as long as the total emissions reduction is the same or greater, firms can comply by either: (1) reducing emissions from any combination of sources within the plant; or (2) acquiring emissions reductions from another facility.").

[56] *See* Span, *supra* note 6, at 2005 ("One result of this additional uncertainty about pricing is that fewer trades are likely to be made."); Dwyer, supra note 31, at 110 ("Formal rules aside, agency practices and policies can reduce the security of offset rights and create strong disincentives to trade."); Robert W. Hahn & Gordon L. Hester, *Marketable Permits: Lessons for Theory and Practice*, 16 ECOLOGY L.Q. 361, 379 (1989) ("To the extent that future confiscation is probable, the value of rights is reduced and fewer advantageous trades can be made.").

[57] *Cf.* Dwyer, *supra* note 31, at 110 n.44 (1993) ("Unless firms are confident that regulators will not confiscate their reductions, they will be reluctant to bank emission reduction credits, invest in additional controls, make process changes (to create reduction credits), or even make trades." (citing Robert W. Hahn, *Tradeoffs in Designing Markets with Multiple Objectives*, 13 J. ENVTL. ECON. & MGMT. 1, 10 (1986) and Robert W. Hahn & Roger G. Noll, *Implementing Tradeable Emissions Permits*, *in* REFORMING SOCIAL REGULATION: ALTERNATIVE PUBLIC STRATEGIES 125, 132-33 (Leroy Graymer & Frederick Thompson eds., 1982)).

potential holders of TEAs are risk averse, the uncertainty of whether or not the government will confiscate TEAs entails an additional social cost.[58] Ultimately, the confiscation of TEAs or simply insecure TEAs "could undermine the entire process."[59]

At the same time, the science of climate change is constantly evolving based on new historical data and innovative modeling.[60] Moreover, because our environment is not static, the climate itself can change in ways that are not anticipated.[61] Assuming that additional information may become known or that underlying climactic conditions may shift, the ability to adjust quickly in response to these changes is vital.[62] Indeed, an inability to adjust quickly entails a social cost because failing to adjust means that, at least during the interim period, an inappropriate emissions target is in effect.

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[58] *See* Span, *supra* note 6, at 2001 ("The general argument for compensation is that many investors are in fact risk-averse and will underinvest in the face of uncertainty."); Blume & Rubinfeld, *supra* note 8, at 588 ("The absence of compensation imposes costs on risk-averse investors in proportion to their degree of risk aversion.").

[59] TIETENBERG, *supra* note 1, at 193. In addressing the possible problems with uncertainty, I focus solely on two effects: the effect that a lack of compensation would have on the incentive to create TEAs by reducing emissions below the required levels and the effect that a lack of compensation would have on the incentive either to purchase TEAs instead of abating pollution or to abate pollution rather than purchasing TEAS. It is worth noting, however, that uncompensated confiscations also could lead to a number of other problems including suboptimal levels of investment and the premature use of TEAs. Risk of confiscation may lead firms to forego other investments (besides additional abatement) that they would have undertaken if TEAs were secure. The risk of confiscation also may lead firms to use their TEAs sooner than they otherwise would have used them because of a concern about government confiscation. *See generally* Span, *supra* note 6, at 1999-2007 (discussing "the effect of guaranteed compensation on investments decisions, the timing of TEA usage, the amount of TEA treading, and resource stewardship"); *cf.* David A. Dana, *Natural Preservation and the Race to Develop*, 143 U. PA. L. REV. 655, 656 (1995) ("Land use lawyers, developers, and interested government officials seem to agree that uncertainty about future growth controls leads developers to 'engage in speculative land purchases and development.' Anecdotal accounts suggest that the magnitude of accelerated development may be very substantial." (quoting *The Bluegrass Revisited: Regional Strategic Planning for a Vision of the Future Landlines*, LINCOLN INST. OF LAND POL'Y, July 1993, at 3)).

[60] *See, e.g.*, David Weisbach & Cass R. Sunstein, "Climate Change and Discounting the Future: A Guide for the Perplexed," (working paper, 2008) (describing the problem of climate change as "the paradigmatic case of a long-term problem with uncertain effects"); *see also* Daniel A. Farber, *Adapting to Climate Change: Who Should Pay?*, 23 J. LAND USE & ENVTL. L. 1, 5 (2007) (noting "improvements in modeling and data" in the 2007 Report of the Intergovernmental Panel on Climate Change]").

[61] *See* DANIEL A. FARBER ET AL., CASES AND MATERIALS ON ENVIRONMENTAL Law 1 (7th ed. 2006) (pointing out that "the environment itself is dynamic" and that, "[a]s the natural environment changes, and as new information emerges, legal solutions must adapt"); *see also* Nancy C. Doubleday, *Aboriginal Subsistence Whaling: The Right of Inuit to Hunt Whales and Implications for International Environmental Law*, 17 DENV. J. INT'L L. & POL'Y 373, 375-76 (1989) ("When looking at archaeological data, it is important to remember that climate is not static.").

[62] *See* Dwyer, *supra* note 31, at 110 ("Regulators must have the flexibility to respond to new information, such as information on the quantitative relationship between emissions and environmental quality."); *cf.* Cinnamon Carlarne, *Climate Change—The New "Superwhale" in the Room: International Whaling and Climate Change Politics—Too Much In Common?*, 80 S. CAL. L. REV. 753, 787 (2007) (asserting that "it is essential that climate change policymakers look to the lessons offered by past international environmental law regimes . . . in order to shorten the learning curve and create effective policies more quickly").

Of course, theoretically, the government could adjust emissions levels at any time simply by paying compensation to those parties affected by the regulatory change. However, payment of compensation entails two costs that potentially inhibit regulatory flexibility. First, if taxpayers are unwilling to pay just compensation and this type of political opposition inhibits a timely shift to the optimal policy, the losses of not enacting the optimal policy or delaying its implementation constitute social costs. Second, even assuming that taxpayers are willing to pay just compensation, paying compensation has a positive cost for the government. The cost is not the payment of the compensation itself (which is merely a transfer of funds from taxpayers to condemnees) but the cost associated with executing this transfer. This cost may be the result of either taxation's administrative costs or its distortionary effects.[63] Thus, even if taxpayers are willing to compensate TEA holders for confiscating allowances, compensating TEA holders also involves a social cost due to the costs of paying just compensation.[64]

3. *The Assumption Incremental Reductions*

One final assumption of this framework is that the government generally relies on incremental reductions to reach the optimal emissions cap. That is, instead of mandating that firms reduce their emissions to the final target immediately, regulators will mandate a series of maximum emission levels that decrease at a specific rate. (The rate itself might be linear or non-linear.) By relying on incremental reductions, the government gives firms time to implement cost-effective adjustments and recognizes that, in the interim, firms are likely to develop more cost-effective technologies.[65]

As a theoretical matter, this assumption appears to be warranted. From a social perspective, the ideal emissions level in any period is the one that minimizes the sum of the costs of mandating the optimal emissions level immediately (including the productivity losses resulting from an immediate adjustment) and the costs of transitioning to the optimal level (including the environmental damage incurred by continuing to allow

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[63] *See* Steven Shavell, *Eminent Domain Versus Government Purchase of Land Given Imperfect Information About Owners' Valuations*, *at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1023100 ("The government bears a positive social cost per dollar of funds, which may be interpreted as due to the administrative expense of taxation or to its distortionary effects."); Span, *supra* note 6, at 1992 ("In general, settlement costs include the administrative costs of running compensation programs and the economic distortions caused by raising taxes to pay for the compensation. These costs can be quite substantial and provide a reason not to guarantee compensation." (citing WILLIAM A. FISCHEL, REGULATORY TAKINGS: LAW, ECONOMICS, AND POLITICS 96 (1995))).

[64] *Cf.* Span, *supra* note 6, at 2007 (noting the "settlement costs involving in determining the appropriate level of compensation and in finding the funds necessary to provide the compensation," as well as "the possible loss in government flexibility . . . and the possibility that necessary cuts will not be made because the compensation cannot be financed").

[65] *See, e.g.*, RICHARD L. REVESZ & MICHAEL A. LIVERMORE, RETAKING RATIONALITY: HOW COST-BENEFIT ANALYSIS CAN BETTER PROTECT THE ENVIRONMENT AND OUR HEALTH (2008) (pointing out that "innovation and adaptation can cut down on the overall cost of complying with regulation"); *cf.* Natalie M. Derzko, *Using Intellectual Property Law and Regulatory Processes to Foster the Innovation and Diffusion of Environmental Technologies*, 20 HARV. ENVTL. L. REV. 3, 17 (1996) ("Given the importance of developing environmental technology and the fact that much of environmental technology occurs incrementally, an environmental patent regime should also offer the polluting industry opportunities to obtain protection for environmental technologies they develop on their own.").

more emissions than would be optimal if firms could adjust frictionlessly).[66] In short, because transition costs are social costs, these costs must be taken into account as well.

As an empirical matter, this assumption is also realistic. Most trading systems that seek to impose an emissions limitation that is significantly below the current emissions level rely on incremental reductions. For example, while many members of Congress are proposing legislation that requires the United States to reduce its emissions by up to 80% by 2050,[67] no member of Congress, at least to my knowledge, considers it feasible (or even desirable) to establish a cap that requires an immediate 80% reduction.[68] Similarly, many state programs rely on incremental reductions to reach their emissions objectives as well.[69] Thus, the assumption that reductions will be incremental, irrespective of the magnitude of such reductions, appears to be warranted.[70]

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[66] For the sake of simplicity, I also ignore the question of discounting, i.e., whether it is appropriate to take into account opportunity costs. For several views on this issue, *see* Weisbach & Sunstein, *supra* note 62; Richard L. Revesz, *Environmental Regulation, Cost-Benefit Analysis, and the Discounting of Human Lives*, 99 COLUM. L. REV. 941 (1999), K. J. Arrow et al., *Intertemporal Equity, Discounting, and Economic Efficiency*, *in* CLIMATE CHANGE 1995: ECONOMIC AND SOCIAL DIMENSIONS OF CLIMATE CHANGE (James P. Bruce et al. eds., 1996); Robert C. Lind, *Intergenerational Equity, Discounting, and the Role of Cost-Benefit Analysis in Evaluating Global Climate Policy*, 23 ENERGY POL'Y 379 (1995).

[67] *See, e.g.*, RICHARD L. REVESZ, ENVIRONMENTAL LAW AND POLICY (2008) (pointing out that under the Lieberman-Warner bill, "the only market-based GHG-reductions proposal to have made it out of committee," the 2012 cap would be set at the 2005 emissions level and "would be progressively reduced (by 10 percent by 2018; by 30 percent by 2028; by 50 percent by 2039) such that by 2050, the cap would be set at a level 70 percent below the 2005 emissions level" (citing GovTrack.us. S. 2191—110th Congress (2007): America's Climate Security Act of 2007, http://ww.govtrack.us/congress/bill.xpd?bill=s110--2191 (last visited Feb. 9, 2008))); Alan Carlin, *Global Climate Change Control: Is There a Better Strategy than Reducing Greenhouse Gas Emissions?*, 155 U. PA. L. REV. 1401, 1434 (2007) ("The two bills introduced into the U.S. Congress in 2006 specify a goal of an 80% reduction in CO_2 emissions by 2050 from 1990 levels in order to prevent more than a 2°C rise in temperature above the preindustrial average and global atmospheric concentrations of GHGs (presumably they actually mean CO_2) from exceeding 450 ppm.").

[68] Perhaps the closest parallel to this type of immediate, drastic reduction is the efforts of the Chinese government to clear the skies above Beijing in anticipation of the 2008 Summer Olympics. *See, e.g.*, Jim Yardley, *China Reveals Backup Pollution Controls*, N.Y. TIMES at A6 (Aug. 1, 2008) (describing implementation of significant restrictions on cars and factories including the removal of 300,000 high-polluting vehicles, enforcement of alternate-day driving restrictions, reduction of factory production in Beijing and nearby areas, and closure of most major construction sites).

[69] *See, e.g.*, PEW CENTER ON GLOBAL CLIMATE CHANGE, LEARNING FROM STATE ACTION ON CLIMATE CHANGE (Feb. 2006) (update) ("In a 2005 executive order, California Governor Arnold Schwarzenegger committed to GHG reduction targets equivalent to reaching 2000 emissions levels by 2010, 1990 levels by 2020, and 80% below current levels by 2050. Governor Bill Richardson of New Mexico also signed a 2005 execute order to set GHG targets at achieving 2000 emissions levels by 2012, 10% below 2000 levels by 2020, and 75% below 2000 levels by 2050."), *quoted in* FARBER ET AL., ENVIRONMENTAL LAW, *supra* note 63, at 57-58.

[70] The primary focus of this analysis is on reducing emissions, but it is also possible that the government could set a limit that is too stringent and subsequently decide to increase the number of TEAs. The possibility that the government might issue additional TEAs means that TEAs might involve a "givings," as well as a takings, issue. *See generally* Abraham Bell & Gideon Parchomovsky, *Givings*, 111 YALE L.J. 547, 549-50 (2001) ("[W]hen the government relaxes environmental regulations, a giving occurs."). While the government could engage in this type of giving (assuming the giving does not conflict with any applicable statutes or regulations), the issue is whether regulated entities should be required to pay for these newly-issued TEAs. I contend that, regardless of whether TEAs are distributed initially through grandfathering or auctions, the government should auction TEAs for any subsequent increases. The

B. Comparative Analysis

In this section, I compare the three legal rules described above—full property protection, no property protection, and quasi-property protection—to determine the optimal legal rule for TEAs. In the first part, I consider the optimal rule for TEAs when the government has perfect information. In the second part, I consider the optimal rule for TEAs when the government's information is imperfect. In the third part, I summarize my conclusions.

1. *With Perfect Information*

With perfect information, the government knows the optimal level of emissions for each period of time in the future. That is, regulators know both the marginal cost and marginal benefit of reducing each unit of pollution for each period in the future. Regulators also know the costs of transitioning to this optimal level and therefore know the corresponding rate of emissions reductions.[71] For example, based on the hypothetical above,[72] regulators might know that the optimal amount of pollution is 100 metric tons in 2010, 60 metric tons in 2030, and 20 metric tons in 2050 and thereafter.

Suppose the government initially distributes (either free of charge or via an auction) a total of 100 TEAs to five existing firms. If each of the five firms is initially emitting the same level of pollution, the government might issue 20 TEAs to each firm or each of the firms might purchase twenty TEAs at the auction.[73]

With *full property protection*, the government is required to compensate TEA holders for all takings.[74] Thus, the government would have to pay compensation for confiscating 40 TEAs in 2030 and 40 TEAs in 2050. As a result, existing TEA holders would not face any regulatory uncertainty. However, the payment of just compensation

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possibility of future distributions of free allowances might distort the current trading price of existing TEAs because, among other things, certain emitters, anticipating the possibility of a gratuitous transfer, might delay purchasing TEAs, thereby artificially reducing the demand for TEAs, or might lobby for free TEAs, thereby wastefully increasing the amount of rent-seeking behavior.

[71] *Cf.* Thomas W. Merrill, *Explaining Market Mechanisms*, 2000 U. ILL. L. REV. 275, 284 (noting that each of the first eight TEA programs in the United States "arises in a context where the standard for acceptable levels of pollution has been independently and authoritatively established before the market mechanism was put in place" (citing GERT TINGGAARD SVENDSEN, PUBLIC CHOICE AND ENVIRONMENTAL REGULATION 72 (1998))).

[72] *See supra* Part III.A.1.

[73] Assuming timely compliance with each of the caps, this would mean that between 2010 and 2100 total emissions would be no higher than 4,200 units of pollution. (100 x 20 + 60 x 20 + 20 x 50 = 4,200). Of course, the government could achieve the same level of emissions by setting an immediate emissions cap of 41.67 units per year. However, as noted above, the government might choose to rely on incremental reductions to minimize the sum of transition costs and pollution costs. For the sake of simplicity, I also focus only on overall emissions and ignore the rate at which CO_2 remains in the atmosphere.

[74] *See supra* Part. III.A.1.

does entail a social cost.[75] The social costs of full protection would be the costs of paying just compensation for 40 TEAs in 2030 and 40 TEAs in 2050.

With *no property protection*, the government is not required to compensate TEA holders for takings. Thus, the government would not have to pay compensation for confiscating 40 TEAs in 2030 or 40 TEAs in 2050. If the government did not announce the caps in advance, then holders of TEAs might face uncertainty regarding the number of allowances available in the future. However, with perfect information, the government could specify each cap in advance. Thus, not only would compensation costs be 0, but, because firms would not face any uncertainty, uncertainty costs would be 0 as well.

With *quasi-property protection*, 1 TEA would entitle its holder to emit 1 unit of pollution in 2010, 0.6 units of pollution in 2030 and 0.2 units of pollution in 2050. As noted above, with quasi-property, TEA holders are not entitled to any compensation for *expected* reductions; however, *unexpected* reductions are compensable.[76] Here, quasi-property would eliminate the costs of providing compensation because, with perfect information, the government could set the initial rate of reduction at the optimal rate. Consequently, no unexpected reductions would be necessary. Moreover, because the government has perfect information, holders of TEAs would have accurate beliefs about their legal entitlements and thus would not bear any uncertainty costs.

Overall, when the government has perfect information, giving no protection is superior to giving full property protection. Unlike full protection, no protection does not entail the social costs of compensating for expected reductions. Giving quasi-protection is superior to giving full protection for the same reason: unlike full protection, quasi-protection does not entail the costs of compensating for expected reductions. Finally, giving no protection and giving quasi-property protection are functionally equivalent. Both rules entail neither compensation costs nor uncertainty costs.

2. *With Imperfect Information*

With imperfect information, the government is not certain, at the time of the initial allocation, of the optimal cap for each period in the future. Regulators do, however, have a certain degree of information regarding future periods and thus have a belief about the optimal cap for each of these periods. Presumably, regulators generally have more information for periods closer to the initial allocation and less information for periods further from the initial allocation. For example, in 2010 regulators might know with certainty that the optimal number of TEAs is 100 in 2010, but might believe that the optimal number of TEAs in 2030 is 80 with a 50% probability and 60 with a 50% probability.[77] Assume that in 2010 the government issues 100 TEAs to five existing firms and also decides to set the cap for 2030 at 80 (rather than 60).

[75] *See supra* Part III.A.2(b).

[76] *See supra* Part III.A.1.

[77] Either of these might be optimal even if the ultimate objective remains an 80% reduction by 2050 because the optimal rate of emissions reductions may be non-linear.

With *full property protection*, the state has to compensate TEA holders for all reductions. Thus, if the government continued to keep the limit for 2030 at 80, it would have to pay compensation in 2030 for the taking of 20 TEAs. However, if the government concluded in 2030 that it previously had underestimated potential harm and thus decided to lower the limit to 60, it would have to pay compensation for 40 TEAs. Knowing they would be compensated for any reduction (and knowing that compensation would be full compensation), firms would not face any uncertainty. However, the government would incur the costs of paying compensation, both for the 20 TEAs that it had expected to take and for the additional 20 TEAs it confiscated because of its misestimation. Overall, because there is a 50% chance of 80 being optimal (with a corresponding reduction of 20 TEAs) and a 50% chance of 60 being optimal (with a corresponding reduction of 40 TEAs), the expected social costs would be the social costs of compensating for the reduction of 30 TEAs.

With *no property protection*, the government does not have to compensate TEA holders for reductions. Thus, if the optimal number of TEAs is 80, the government would not have to pay compensation for confiscating 20 TEAs in 2030. If the optimal cap turned out to be 60, the government also would not have to pay compensation for taking 20 additional TEAs. The social costs of compensation are therefore 0. However, because the government's information is imperfect, TEA holders do face uncertainty. If TEA holders relied on the government's initial projection of 80 by 2030 and that projection turned out to be accurate, then presumably holders would have engaged in the optimal mix of cost-justified pollution reductions and allowance trades. However, if holders relied on the government's initial objective of 80 by 2030, and the government's initial projection turned out to be inaccurate (meaning that the government confiscated an additional 20 TEAs in 2030), holders would have undervalued their TEAs and failed to take certain abatement actions that were cost-justified.[78] Thus, when the government's information is imperfect, the absence of property protection would result in uncertainty, and this uncertainty, as discussed above, entails a positive social cost.[79]

With *quasi-property protection*, 1 TEA entitles its holder to emit 1 unit in 2010 and 0.8 units in 2030. If the government's information regarding 2030 turned out to be accurate, holders of TEAs would not receive any compensation because the 20% reduction was expected. If the government's information regarding 2030 turned out to be inaccurate (and the government confiscated an additional 20 TEAs in 2030), holders of TEAs would receive compensation, but only for the unexpected reduction (i.e., the difference between being able to emit 0.8 units and 0.6 units, or one-fifth, of a TEA). Because the initial reduction is expected and because the unexpected reduction is compensated, TEA holders would not face any uncertainty. However, because compensation would be paid for the unexpected reduction, the expected social cost would be the probability of an unexpected reduction (0.5), multiplied by the number of TEAs (100), multiplied by the social costs of providing compensation for one-fifth of a TEA.

[78] Conversely, if firms had mistakenly believed that the state would reduce the number of permits to 60 in 2030 and the government ultimately confiscated only 20 TEAs in 2030, these firms would have overvalued the permits and might have taken certain abatement measures that were not cost-justified.

[79] *See supra* Part III.A.2(a).

Overall, when the government's information is imperfect, quasi-property protection is unambiguously superior to full property protection. Neither full protection nor quasi-protection involve any uncertainty costs. However, in addition to paying compensation for unexpected reductions (i.e., when the government's information turns out to be inaccurate), full protection entails the costs of compensating for expected reductions (i.e., when the government's information turns out to be accurate). By contrast, with quasi-property protection, the cost of compensation only includes the cost of compensating for unexpected reductions. Thus, the costs of quasi-property protection are necessarily lower than the costs of full-property protection.

With imperfect information, no property protection and quasi-property protection each entail different costs. While no protection does not entail compensation costs, it does entail the costs associated with uncertainty. By contrast, although quasi-protection does not entail uncertainty costs, it does entail the costs of providing compensation for unexpected reductions. If the costs of providing this compensation are greater than the costs due to uncertainty, then no-property protection is superior. However, if the costs of providing this compensation are less than the costs due to uncertainty, then quasi-property protection is superior. Therefore, whether no protection or quasi-protection is superior is ambiguous.

Similarly, whether full property protection or no property protection is superior under imperfect information is also ambiguous. The answer depends on the costs of uncertainty versus the costs of compensation. While full protection does not entail uncertainty costs, it does entail compensation costs. By contrast, although no protection does not entail compensation costs, it does entail the costs associated with uncertainty. If the costs of this uncertainty are greater than the costs of compensation, then full protection is superior. If the costs of uncertainty are less than the costs of compensation, then no protection is superior.

3. *Summary*

The foregoing analysis leads to three overall conclusions. First, quasi-property protection is unambiguously superior to full-property protection because it is superior under both perfect and imperfect information. Because quasi-property only requires compensation for unexpected reductions, quasi-property reduces compensation costs. Second, it is unclear whether no protection is superior to full protection. Although no protection is unambiguously superior when the government has perfect information, the result is ambiguous when the government's information is imperfect. However, because quasi-property is unambiguously superior to full property, it is at the very least clear that full property is not the best outcome. Third, it is also unclear whether quasi-protection is superior to no protection. Although the two rules are functionally equivalent when the government has perfect information, the outcome under imperfect information depends on whether the uncertainty costs of no protection or the compensation costs of quasi-protection are higher. Ultimately, this question is an empirical one.

C. Resolving the Empirical Uncertainty

As an empirical matter, it seems plausible that the uncertainty costs of no property protection might be greater than the compensation costs of quasi-property protection. Again, "compensation costs" are only the social costs of paying just compensation, not the amount of the compensation itself.[80] Quasi-protection may have an additional advantage as well. With quasi-protection, the government must pay just compensation whenever it unexpectedly adjusts the maximum allowable emissions level; consequently, regulators might have an incentive to be as accurate as possible in predicting emissions levels for future periods.[81] Still, ambiguity remains regarding whether uncertainty or compensation costs are higher.

One way of addressing this question is to allow the TEA holders themselves to choose between no-property protection and quasi-property protection. But there is a problem with this type of election: TEA holders' private incentives in choosing between the two rules will not necessarily be aligned with the optimal social outcome. TEA holders are compensated for unexpected reductions under quasi-property but are not compensated for unexpected reductions under no property. However, typically, TEA holders themselves do not bear the social costs associated with paying compensation; these costs ultimately accrue to taxpayers in general. Thus, because TEA holders would obtain the benefits of compensation without incurring the costs of compensation, TEA holders would always choose quasi-property protection over no property protection.

However, quasi-protection could be modified slightly to include an additional requirement: TEA holders that elect quasi-property could be required to reimburse the government for the social costs of paying compensation. As a result of having to internalize these costs, a TEA holder's private incentive in choosing between no protection and quasi-protection would be aligned with the optimal social outcome. On one hand, firms that wish to avoid the uncertainty associated with no protection and that believe the costs of such uncertainty would be greater than the costs of reimbursing the government for the social costs of compensation would choose quasi-protection. On the other hand, firms that believe the costs of reimbursing the government would be greater than the costs of uncertainty would choose no protection.[82] It is likely that most firms would choose quasi-protection, although, conceivably, a firm that is capable of adjusting its technology at very little cost might prefer no protection. In any event, each firm would elect one of the two rules and, in so doing, social welfare would be maximized.

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[80] *See supra* note 65 and accompanying text.

[81] *But cf.* Daryl J. Levinson, *Making Government Pay: Markets, Politics and the Allocation of Constitutional Costs*, 67 U. CHI. L. REV. 345, 345 (2000) ("Government actors respond to political incentives, not financial ones—to votes, not dollars. We cannot assume that government will internalize social costs just because it is forced to make a budgetary outlay.").

[82] Of course, it is possible that initial TEA holders may not have the same preferences as subsequent TEA purchasers. For example, all of the initial holders might choose quasi-protection even though one or more of the subsequent purchasers prefers no protection. Conversely, all of the initial holders might choose no protection even though one or more of the subsequent purchasers prefers quasi-protection. To remedy this problem, the government should permit TEA holders to convert their entitlements from quasi-protection to no protection (and vice-versa) whenever a transfer occurs.

IV. THREE OBJECTIONS REGARDING TEAS

A. Price Controls

The price of TEAs in some trading systems has been known to fluctuate dramatically. For example, during the summer of 1999, because of seasonal restrictions, the price of a tradable permit in NO_X in the northeastern United States declined from over $5,000 per ton to just over $1,000 per ton.[83] Similarly, during the summer of 2000, because of the difficulties in California's electricity markets,[84] the price of NO_X trading credits in the RECLAIM program skyrocketed to over $45,000—ten times the value of the credits during the previous year.[85] Price fluctuations also may occur if the initial allocation of TEAs is erroneous and the government subsequently adjusts the number of allowances. This misallocation may occur either because of political considerations, which sometimes militate in favor of grandfathering an excessive number of permits, or because of scientific and economic uncertainty, which often make it difficult to determine the optimal number of permits.[86] Obviously, too many allowances will result in a price that is too low; too few allowances will result in a price that is too high.

As discussed above, using quasi-property protection addresses the uncertainty that TEA holders may face because of unexpected reductions (e.g., new seasonal restrictions).[87] Yet, quasi-property does not address the uncertainty associated with other causes of price volatility (e.g., difficulties in an interrelated market such as the market for electricity). The government could conceivably attempt to address not only the uncertainty associated with unexpected reductions but also other types of uncertainty as well. For example, the government could regulate the price of TEAs either by (i) establishing a price floor or a price ceiling, or (ii) "pegging" the price of TEAs by adding and removing TEAs, as necessary, to prevent any price fluctuations. However, as discussed below, neither of these types of price controls is necessarily better than quasi-property; and, both types of controls may introduce additional distortions in TEA markets.

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[83] *See* Eric T. Mansur, *Upstream Competition and Vertical Integration in Electricity Market*, 50 J.L. & ECON. 125, 136 (2000) ("Beginning in 1999, the Ozone Transport Commission required units in Delaware, Pennsylvania, and New Jersey (and others in New York and New England), to dramatically reduce May through September emissions. In May 1999, permit prices exceeded $5,000 per ton, increasing some units' marginal costs by 50 percent, but fell precipitously to $1,093 by summer's end.").

[84] *See supra* Part II.A.2.

[85] *See* TIETENBERG, *supra* note 1, at 12 ("During the summer of 2000, problems with California's electricity deregulation program spilled over into the RECLAIM market, resulting in a sharp and sudden increase in credit prices. Specifically, 'the average price of NO_X RTCs for compliance year 2000, traded in the year 2000, increased sharply to over $45,000 per ton compared to the average price of $4,284 per ton traded in 1999.'" (quoting South Coast Air Quality Management District, "White Paper on Stabilization of NO_X RTC Prices," Diamond Bar, CA: South Coast Air Quality Management District (2001))).

[86] *See id.* at 142 ("Case studies, especially of the RECLAIM program and the Kyoto trading system, reveal some tendency to over-allocate quota in the initial program years to gain political feasibility for the system.").

[87] *See supra* Part III.A.1.

1. *Constructing Floors and Ceilings*

To see why price floors and ceilings would distort the market for TEAs, consider a numerical example. Suppose the optimal level of NO_X is 100 tons per year and that no firm is permitted to emit more than 20 tons per year. Five firms currently emit NO_X, with each firm emitting 25 tons annually. Thus, to comply with the new emissions level, each firm needs to reduce its annual emissions by 5 tons over the next year or, alternatively, purchase allowances from other firms to offset its excess pollution. Each of these firms can reduce an additional ton of NO_X if it takes certain abatement measures, but the cost of abatement differs with each firm: Firm 1 can reduce up to 10 tons for a total cost of $10,000 or $1,000 per ton; Firm 2 can reduce up to 10 tons at a total cost of $20,000 or $2,000 per ton; Firm 3 can reduce up to 10 tons at a total cost of $30,000 or $3,000 per ton; Firm 4 can reduce up to 10 tons at a total cost of $40,000 or $4,000 per ton; and Firm 5 can reduce up to 10 tons at a total cost of $50,000 or $5,000 per ton.[88]

Suppose the equilibrium price of TEAs is $3,000 per ton. At this price, Firm 1 and Firm 2 will both reduce their emissions by 10 tons. These firms have an incentive to reduce the first five tons to comply with the emissions level because their abatement costs, $1,000 and $2,000, respectively, are each lower than the costs of buying TEAs for $3,000 per ton. These firms also have an incentive to reduce their emissions by another five tons because they can profit by selling the allowances created by their additional reductions as the current price of TEAs, $3,000, is higher than their abatement costs.[89] Firm 3 will be indifferent between reducing its emissions level through abatement and purchasing TEAs because its abatement costs, $3,000 per ton, are equal to the costs of TEAs, $3,000 per ton. Firm 4 and Firm 5 will both purchase 5 TEAs rather than reducing their emissions by 5 tons. These firms have an incentive to purchase TEAs because their abatement costs, $4,000 and $5,000, respectively, are each higher than the costs of buying TEAs for $3,000 per ton. Thus, in this example, Firm 1 might sell its 5 excess TEAs to Firm 4 and Firm 2 might sell its 5 excess TEAs to Firm 5.

Trading is efficient here because the costs of reducing emissions by 25 tons when trading is permitted are less than the costs of reducing emissions by 25 tons when trading is not permitted. Specifically, with trading, Firm 1 decreases its emissions by 10 tons at a total cost of $2,000, Firm 2 decreases its emissions by 10 tons at a total cost of $4,000, and Firm 3 decreases its emissions by 5 tons at a total cost of $3,000. Thus, the overall costs of reducing emissions by 25 tons with trading is $9,000 ($2,000 + $4,000 + $3,000). By contrast, without trading Firms 1, 2, 3, 4, and 5, will each decrease their emissions by 5 tons for a total cost, respectively, of $1,000, $2,000, $3,000, $4,000, and $5,000. Thus, the overall costs of reducing emissions by 25 tons without trading is $15,000 ($1,000 + $2,000 + $3,000 + $4,000 + $5,000). The costs with trading, $9,000, are clearly less than the costs without trading, $15,000.

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[88] Here I again assume that the marginal cost of reducing an additional ton of NO_X is linear for each firm.

[89] *Cf.* Span, *supra* note 6, at 1989 (noting that, under the CAA's emissions reduction credit (ERC) programs, "if a factory is assigned a baseline of twenty tons of sulfur dioxide emissions per year, and it makes permanent changes in its production process that reduce its emissions to fifteen tons per year, it can sell the right to emit five tons of sulfur dioxide to another factory governed by the ERC program").

However, consider the outcome if the government constructed a price floor. Suppose the government established a price floor of $4,500 per ton; that is, the market price of TEAs could not fall below $4,500. Now, because Firm 4 can reduce its own emissions for $4,000 per ton, Firm 4 will have an incentive to rely on its own abatement measures rather than to purchase TEAs. However, if the actual price of TEAs (i.e., the market price in the absence of the price floor) is below $4,000 (e.g., if the equilibrium price remains at $3,000), Firm 4's abatement is inefficient: it would be better for another firm to reduce its emissions at a lower cost and sell its excess allowances to Firm 4 than for Firm 4 to reduce its own emissions at a higher cost. Thus, a price floor may lead firms to engage in abatement measures that are not cost-justified.

Similarly, consider the outcome if the government constructed a price ceiling.[90] Suppose the government established a price ceiling of $1,500 per ton; that is, the market price of TEAs could not exceed $1,500. Now, because Firm 2 can purchase TEAs for $1,500 per ton, Firm 2 will have an incentive to purchase these TEAs rather than reduce its own pollution levels. However, if the actual price of TEAs (i.e., the market price in the absence of the price ceiling) is above $2,000 (e.g., if the equilibrium price remains at $3,000), Firm 2's purchases are inefficient: it would be better for Firm 2 to reduce its own emissions than for Firm 2 to purchase TEAs from another firm. Thus, a price ceiling may lead firms to refrain from abatement measures that are cost-justified.

2. *Pegging*[91]

Instead of constructing a price floor or a price ceiling to limit price volatility, the government could attempt to eliminate any uncertainty by "pegging" the price of TEAs. The government might decide on a particular price beforehand and then, as the price begins to fluctuate, either decrease the supply of TEAs or increase the supply of TEAs to keep the price constant. For example, if the price of TEAs was beginning to rise, the government could simply increase the supply of TEAs (by distributing or auctioning additional TEAs) and drive down the price. Conversely, if the price of TEAs was beginning to fall, the government could simply decrease the supply of TEAs (by buying or confiscating additional TEAs) and drive up the price. In this way, the government could potentially eliminate all price uncertainty associated with TEAs.

However, the problem with pegging is that, while pegging eliminates uncertainty for TEA holders, it may lead to either too much pollution or too little production. If the price of TEAs increases, the government could counteract the price increase by increasing the supply of TEAs. However, increasing the supply of TEAs means that firms would be permitted to emit more pollution.[92] While additional production would

[90] *See* REVESZ, *supra* note 69, at 179 (noting that the Bingam-Specter bill, S. 1766 110th Cong. (2007), "would not limit the total number of [international reserve] allowances, but it would give the President discretion in determining the price at which they are auctioned (subject to an upper limit)").

[91] I thank Professor David Weisbach for bringing this possibility to my attention.

[92] *Cf.* Dwyer, *supra* note 31, at 110 ("This risk . . . is that flexibility will become an excuse for regulatory caprice. This may be inevitable when regulators accustomed to command and control techniques are made

also occur, the economic benefits of this production would be more than offset by the environmental costs of this production. After all, the initial emissions level was presumably set at the point at which the marginal cost of an additional allowance equals the marginal benefit of an additional allowance. By increasing the supply of TEAs solely to stabilize the price, the government is authorizing allowances even though the marginal cost of an additional TEA exceeds the marginal benefit.

Conversely, if the price of TEAs decreases, the government could counteract the price decrease by restricting the supply of TEAs. However, decreasing the supply of TEAs means that firms now would be permitted to emit less pollution. While less environmental damage would occur, these environmental benefits would be more than offset by the economic costs of lost production. Once again, the initial emissions level was presumably set at the point at which the marginal cost of an additional allowance equals the marginal benefit of an additional allowance. By decreasing the supply of TEAs solely to stabilize the price, the government is restricting allowances even though the marginal benefit of an additional TEA exceeds the marginal cost.

Thus, although pegging the price of TEAs eliminates price uncertainty, pegging results in other costs: specifically, either too much pollution (where the marginal cost of an additional TEA exceeds the marginal benefit) or too little production (where the marginal benefit of an additional TEA exceeds the marginal cost). In contrast, quasi-property protection guarantees compensation for unexpected reductions but otherwise allows the market price to fluctuate. By not pegging the price of TEAs, quasi-property allows the government to set emissions at the optimal level, that is, at the point at which the marginal benefits of an additional unit of production equal the marginal costs of an additional unit of production.

B. Time Limitations

As discussed above, one of the advantages of quasi-protection is that it takes into account the importance of regulatory flexibility. Another approach that some commentators have offered for ensuring such flexibility is to rely on "time-limited" allowances with staggered expiration dates.[93] Using allowances with staggered expiration dates permits the government to retire a number of allowances each year without undermining allowance holders' investment-backed expectations. Thus, the government is able to decrease the overall level of emissions on a regular basis.[94]

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responsible for creating stable market conditions. The temptation to seize market surplus to achieve other regulatory goals may be greater than the regulators can withstand.").

[93] *See* Fennell, *supra* note 8, at 1476 n.283 (citing DANIEL H. COLE, POLLUTION AND PROPERTY: COMPARING OWNERSHIP INSTITUTIONS FOR ENVIRONMENTAL PROTECTION 47-48 (2002) (discussing J.H. DALES, POLLUTION, PROPERTY AND PRICES: AN ESSAY IN POLICY-MAKING AND ECONOMICS 95 (1968))); *cf.* Eric T. Freyfogle, *Water Justice*, 1986 U. ILL. L. REV. 481, 509 ("Water boards can issue water permits for specific, nonperpetual terms, and can set staggered expiration dates, an approach that would leave at least some water regularly available for state reallocation.").

[94] *See id.* ("By staggering expiration dates, government could assure itself an ability to remove some percentage of the permits in any given year." (citing Tom Tietenberg, *The Tradable Permits Approach to*

In certain respects, staggering with time-limited allowances is similar to using quasi-property protection. With both time limitations and quasi-property, regulators are charged, in the initial period, with determining the optimal emissions level and deciding when allowances will be retired or discounted. Indeed, in functional terms, issuing allowances with staggered expiration dates could be equivalent to quasi-protection if retiring staggered allowances was mandatory and if other confiscations automatically triggered just compensation. However, as discussed below, using time limitations is less effective than relying on quasi-protection if, as is normally the case, the government retains discretion either (i) to refrain from retiring allowances when they expire or (ii) to confiscate allowances at other times without providing compensation.

1. *Staggering With Ex Post Discretion*

If the government retains the discretion of whether or not to retire the expired TEAs ex post, then staggering with time limitations creates more uncertainty than quasi-property. Specifically, with quasi-property, TEA holders know that the value of their entitlement will decrease at the time of expected reductions and that they will be compensated for any unexpected reductions. Therefore, they can plan accordingly in engaging in the optimal mixture of abatement measures and TEA purchases. On the other hand, with staggering, TEA holders bear a certain degree of uncertainty if they do not know whether the government will exercise its discretion to retire the TEAs when they expire. As a result, certain polluters that expect a retirement of expired TEAs that subsequently does not occur may mistakenly engage in abatement when they should have purchased TEAs; other polluters that do not expect a reduction that subsequently does occur may mistakenly purchase TEAs when they should have engaged in abatement. Thus, if retiring expired TEAs is discretionary, staggering involves more uncertainty than quasi-property.

2. *Confiscating Without Ex Ante Guarantees*

Staggering with time limitations also creates more uncertainty than quasi-property if there is no ex ante guarantee the government will provide compensation for unexpected reductions. Specifically, if the government wants to reduce emissions more quickly than TEAs are expiring, the government might decide to confiscate TEAs. If the government confiscates these TEAs without any compensation (or even if the government provides compensation but there is some uncertainty as to whether it will compensate), holders of TEAs will bear the costs of this uncertainty. As discussed above, quasi-property protection provides compensation in precisely these circumstances, thus eliminating the costs of such uncertainty.[95] On the other hand, if the government only reduces the number of TEAs when they expire, the government will have less flexibility with

Protecting the Commons: What Have We Learned?, *in* THE DRAMA OF THE COMMONS 197, 206 (Elinor Ostrom et al. eds., 2002))).

[95] *See supra* Part III.B.2.

staggering than with quasi-property.[96] Thus, if the government does not guarantee compensation for confiscations of unexpired TEAs, staggering will involve more uncertainty than quasi-property, and, if the government chooses not to engage in unexpected confiscations, staggering will involve less flexibility than is possible under quasi-property.

C. Political Restraints

It could be argued that, as an empirical matter, various types of property protection for TEAs, including quasi-property protection, are unnecessary because government officials will not, in fact, confiscate TEAs. This argument is premised on the public choice insight that regulated entities, such as polluting firms, that are repeat players in the political process and that have relatively high stakes or concentrated interests in the outcome of that process will have certain organizational advantages over others who are either not repeat plays or who have relatively low stakes or diffuse interests in the outcome. According to this argument, polluting firms will use these their organizational and lobbying advantages to prevent any confiscations of TEAs or drastic reductions in their value.

The late Professor Henry Span advances this argument in asserting that, in most circumstances, compensation for TEA confiscations is unnecessary:

> [W]hile there are some policy reasons for guaranteeing compensation, public choice theory suggests that guarantees will lead to overprotection of TEA-holder interests more often than they will prevent underprotection. This is because in most TEA settings, the regulatees will enjoy organizational advantages that enable them to protect themselves politically from unexpected regulatory jolts such as confiscation without compensation.[97]

Span points out that industrial polluters constitute a "relatively small group with high stakes that is organized by industry, all characteristics conducive to low organization costs."[98] He concludes that, "if there is a bias in government decisionmaking, it will be in favor of not cutting TEAs and providing compensation when it does cut them."[99]

The problem with Professor Span's argument in particular, as well this public choice argument in general, is that there are several reasons to doubt whether, empirically, the likelihood of uncompensated confiscations is actually negligible. As an initial matter, if the entities being regulated actually did have overwhelming political power, as Span seems to suggest, then it is unclear why various emissions caps would

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[96] *Cf.* Fennell, *supra* note 8, at 1476 n.283 (noting that the staggering approach "might provide insufficient flexibility to address major changes in environmental factors or scientific knowledge").

[97] Span, *supra* note 6, at 1984. Span also examines a number of other alternatives to compensation including verbal assurances not to confiscate, *see id.* at 2007, additional procedures prior to confiscation, *see id.*, and predictable actions among regulators, *see id*.

[98] *Id.* at 2012-13.

[99] *Id.* at 2012.

have been adopted in the first place. Indeed, many commentators have considered this same public choice account in contemplating how *any* environmental laws have been enacted. Regulated industries almost always have a more concentrated interest than members of the general public; yet, clearly, as almost forty years of modern environmental laws demonstrate, officials are often willing and able to enact laws regulating these industries despite their organizational advantages.[100]

In addition, even if we assume there are alternative reasons why certain emissions restrictions may have initially passed (perhaps existing polluters supported certain restrictions to impede the entry of competitors), it is unclear why these polluters would still be concerned about price uncertainty due to unexpected confiscations. If confiscations were unlikely, firms would not be concerned about the risk of investing in additional abatement measures to create new TEAs or purchasing TEAs from others. Yet, as discussed above, uncertainty in a number of TEA markets has resulted in price volatility as well as concerns that particular markets might unravel.[101]

Finally, the claim that TEA holders will necessarily be able to exert their political influence to prevent "unexpected regulatory jolts such as confiscation without compensation" is belied by the fact that such uncompensated confiscations have, in fact, occurred. For example, as noted above in reference to the SCAQMD emissions program that preceded RECLAIM, "in June 1990, the SCAQMD discounted most banked credits by eighty percent, thereby confirming industry's fears about regulators' confiscatory tendencies."[102] Because the risk of confiscation appears to be nontrivial, simply relying on lobbying efforts by relatively well-organized industries is an inadequate solution for addressing uncertainty costs that currently exist.

V. A PUZZLE REGARDING PROPERTY AND COMPENSATION

[***SECTION IN PROGRESS***]

[In this section, I intend to explore a related puzzle that has developed in recent years. Traditional tangible entitlements, like land (real estate) and chattels (personal property), that arose spontaneously are almost universally treated as property. By contrast, modern intangible entitlements, like IP rights and TEAs, that are deliberately created as an instrument of social policy are treated in different ways. Like land and chattels, IP rights are usually defined as property and typically create an obligation to compensate. By contrast, TEAs are often not characterized as property and normally do not create an obligation to compensate. The relevant distinction cannot be tangible versus intangible or bottom-up versus top-down because IP rights are treated like real property. I examine if there is a functional justification for distinguishing between entitlements in this way.]

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[100] *See generally* RICHARD J. LAZARUS, THE MAKING OF ENVIRONMENTAL LAW 42 (2004) ("Environmental law in the United States has not only overcome the substantial and political obstacles to its enactment, but has persisted and strengthened over its three-decade-plus history.").

[101] *See* Part III.A.2(a).

[102] Dwyer, *supra* note 31, at 110.

VI. CONCLUSION

Neither proponents nor opponents of property protection for TEAs have it completely right. Advocates of full-property protection are correct in pointing out that full protection reduces uncertainty costs. Yet, it is also sometimes optimal, because of transition costs, for the government to issue a higher number of TEAs initially even though it anticipates subsequent reductions. Providing compensation for these expected reductions entails unnecessary social costs. At the same time, advocates of no protection are correct in emphasizing the need for regulatory flexibility. Yet, it is also sometimes optimal, because of uncertainty costs, for the government to provide compensation for unexpected reductions. Providing compensation for unexpected reductions decreases uncertainty costs. Quasi-property protection, by incorporating expected reductions into the entitlement itself and by providing just compensation only for unexpected reductions, attempts to minimize the sum of both compensation costs and uncertainty costs.

The potential theoretical advantages of quasi-property could be tested by experimenting with different rules in various regions of the United States. One possibility, which builds on various initiatives that are already being implemented, is to divide the fifty states (plus the District of Columbia and Puerto Rico) into four regions, each containing its own emissions trading system: the Regional Greenhouse Gas Initiative (RGGI),[103] the Western Climate Initiative (WCI),[104] the Midwest Regional Greenhouse Gas Reduction Accord (Midwest Accord),[105] and, hypothetically, a "Southern Trading Scheme" (STS).[106] Each region could implement a different legal rule. For example, RGGI already has effectively established no-property protection because, under RGGI regulations, a "CO2 allowance" is a "limited authorization" and "does not constitute a property right."[107] The WCI, Midwest Accord, and STS could implement, respectively, full property protection, quasi-property protection, and an

[103] RGGI currently includes eight states: Connecticut, Delaware, Maine, Maryland, New Hampshire, New Jersey, New York, and Vermont. The District of Columbia, Massachusetts, Pennsylvania, and Rhode Island, as well as several Canadian provinces, are observers in the process. If these observers, as well as the Commonwealth of Puerto Rico, eventually join the RGGI, the RGGI would include thirteen jurisdictions (eleven states, the District of Columbia, and Puerto Rico).

[104] WCI includes Arizona, California, Montana, New Mexico, Oregon, Utah, Washington and two Canadian provinces. Observers include Alaska, Colorado, Idaho, Kansas, Nevada, Wyoming, and several Canadian provinces and Mexican states. Kansas is already a member of the Midwest Accord, *see infra* note 119, so it may be less likely to join the WCI than the other observers. If the remaining observers, as well as the state of Hawaii, join the WCI, the WCI would include thirteen states.

[105] The Midwest Accord currently includes six states: Minnesota, Wisconsin, Illinois, Iowa, Michigan, and Kansas. The Accord also includes three observers—Indiana, Ohio, and South Dakota—and the Midwest Governors Association includes three other states—North Dakota, Missouri, and Nebraska. If these twelve states, plus the state of West Virginia, were to become a part of the Midwest Accord, the Accord would have thirteen states as well.

[106] The "STS" could include the remaining thirteen states: Florida, Georgia, Alabama, Mississippi, Louisiana, Texas, Oklahoma, Arkansas, Tennessee, Kentucky, South Carolina, North Carolina, and Virginia. (N.B. The "STS" is a fictional organization created solely for the purposes of this hypothetical.)

[107] Regional Greenhouse Gas Initiative Model Rule XX-1.2(k) (Jan. 5, 2007) (defining "CO2 allowance"), *available at* http://www.rggi.org/docs/model_rule_corrected_1_5_07.pdf.

election between no property protection and quasi-property protection.[108] Each initiative would operate independently of the other initiatives except that TEAs would be freely transferable across regional boundaries. In this way, the market value of TEAs in each region might provide an indication of the optimal rule.

Ultimately, the results of this experiment could be useful in designing national emissions trading systems. Following the Kyoto Protocol, many countries have sought to implement such systems. Yet, unlike the EU ETS, several of these systems are still in the early stages of consideration and development. For example, Japan only recently indicated an interest in implementing a cap-and-trade program.[109] In Australia, there is an ongoing debate regarding a potential trading initiative that could be implemented by 2012.[110] And, in the United States, Congress is currently considering a number of bills that would establish a federal cap-and-trade system.[111] Overall, the shortcomings of initial emissions trading systems provided important lessons for creating the trading systems of today. Perhaps experimenting now with different legal rules will likewise be beneficial for the design, and ultimate success, of trading systems in the future.

[108] PEW CENTER ON GLOBAL CLIMATE CHANGE, LEARNING FROM STATE ACTION ON CLIMATE CHANGE (Feb. 2006) (update) ("The successful implementation of the RGGI model will set the stage for other states to join or form their own regional cap-and-trade systems and may encourage the program to expand to other greenhouse gases and other sectors."), *quoted in* FARBER ET AL., ENVIRONMENTAL LAW, *supra* note 63, at 54-55.

[109] *See* Chisa Fujioka, *Japan Seeks To Design Post-Kyoto Emissions Trading Program*, INT'L HERALD TRIB., Mar. 12, 2008, at 15 ("Japan, one of the world's biggest emitters of greenhouse gases, wants to design an emissions trading program as soon as possible to help it fight climate change after the Kyoto Protocol expires in 2012, the country's environment minister, Ichiro Kamoshita, said Tuesday.").

[110] *See* Saffron Howden, *Tell Us Carbon Price John, Says Flannery*, DAILY TEL. (Sydney), Aug. 23, 2007, at 7 ("Prime Minister John Howard has pledged to introduce a national emissions cap-and-trade scheme in Australia by 2012, but will not commit to an emissions reduction target or a price on carbon before next year—after economic modelling is completed.").

[111] *See generally* John C. Dernbach, *Harnessing Individual Behavior To Address Climate Change: Options For Congress*, 26 VA. ENVTL. L.J. 107, 110 (2008) (discussing seven climate change bills that have been introduced in Congress); REVESZ, *supra* note 69, at 179 (noting that "13 GHG-reduction proposals that employ either tradable permit schemes or emissions taxes have been introduced in Congress" (collecting citations)).

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