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The Costs of Creating Environmental Markets: A Commodification Primer

Michael Pappas* and Victor B. Flatt**

Markets offer a potent tool for managing resources and values, even ones that have not traditionally been commodified. In the environmental context there is particular debate about market-based governance, in terms of both appropriateness and effectiveness. This Article offers a broadly applicable framework for considering the emergence, appropriateness, and design of market tools in environmental governance, and it demonstrates how the model is applicable well beyond that context. This framework offers a powerful diagnostic for programs to manage resources ranging from greenhouse gas emissions to Chesapeake Bay pollution, as well as from human organs to Uber regulation.

As a foundation for this framework, the Article identifies and examines two sets of underappreciated costs associated with establishing and utilizing market mechanisms. It terms these costs “severance costs” and “adjustment failure costs.”

Severance costs describe the costs associated with defining, enforcing, and transacting in marketable “goods.” For instance, to pluck an environmental good from its interconnected ecological and legal context and to attempt to define it as a severable, stand-alone commodity can be costly. Additionally, when such an environmental good is not necessarily associated with tangible, physical ownership or when it has not historically been commodified, further challenges arise in creating the complex institutions necessary for such markets to function. If severance costs are too high, property interests may never be defined or transactions may never occur.

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In addition to severance costs, “adjustment failure costs” inherent in the pricing system represent another critical set of considerations that impact the emergence and success of market mechanisms. In all markets, pricing results from an iterative trial-and-error process, and it takes time and misallocations for supply and demand to align (assuming they ever do). The adjustment failure costs associated with such pricing delays and corrections may be trivial in some markets, but they can be particularly high and material in the context of non-fungible or irreparable goods. Since environmental goods in particular may display such non-fungible or irreparable characteristics, consideration of adjustment failure costs is crucial for environmental market mechanisms because high adjustment failure costs may exceed the potential gains of the market system. Thus, the adjustment failure costs that arise from the iterative function of markets represent another key factor in determining the appropriateness and success of market tools.

This Article posits that severance costs and adjustment failure costs represent the two most significant dimensions for assessing the appropriateness and design of market instruments, both in the environmental context and more broadly. If these costs are too high, either individually or in combination, they will exceed the potential gains of a market system.

Based on these sets of costs, the Article constructs a model for evaluating market emergence and success, and with this framework, the Article makes two major contributions. First, it offers a concrete and pragmatic method for gauging the desirability of market tools for certain resources in the environmental context and beyond. For instance, the model can identify specific situations where a cap-and-trade approach will be less effective than a Pigouvian-tax, or where a licensing system will be superior to a laissez-faire one. Consideration of severance costs and adjustment failure costs offers a generalizable model for describing the feasibility of commodifying environmental goods, prescribing interventions to marginally improve market instruments in general, and evaluating governance approaches for a variety of contexts.

Second, this Article contributes to the theoretical literature on commodification by offering a positive economic framework that can synthesize the leading scholarship and explain existing reservations regarding commodification. It provides a descriptive economic account that can help ground moral intuitions and objections about markets and commodification. As a result, it gives fresh insight into why existing laws and policies are as they are, and it bridges moral and economic arguments, providing a common point of departure for future engagement in these debates.

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INTRODUCTION

Can environmental problems be “solved” with a market solution? In some cases, policies suggest that the answer is yes, and market-based environmental programs already exist. Examples include markets for reducing greenhouse gas emissions,¹ offsetting wetlands’ ecological functions,² or allocating fishing rights.³ However, in other cases the answer appears to be no. For instance, we don’t see an organized market wherein a person can sell her right to clean air to the highest bidder. This disparity raises the question: what separates instances where market-based solutions are desirable (or even allowable) from those where they are not?

1. See, e.g., Victor B. Flatt, *Cap and Trade: The Brave New World of Non-Point Source Nutrient Trading and Using Lessons from Greenhouse Gas Markets to Make It Work*, 52 Hous. L. Rev. 301, 305 (2014).

2. See discussion of Clean Water Act section 404(b) program *infra* notes 60, 69–73, 155.

3. See, e.g., Michael Pappas, *Disclaiming Property*, 42 Harv. Envtl. L. Rev. 391, 398 (2018).

Though there is much controversy over the use of markets in the environmental realm,⁴ the defining conversation surrounding the appropriateness of market mechanisms for environmental governance has centered on normative arguments over the appropriateness of markets at all.⁵ This normative question about rights and commodification is exceptionally important, and its primacy should not be diminished. However, the very normative questions about the appropriateness of markets may be related to how well such markets could possibly work. The potential effectiveness of a market can inform its appropriateness and desirability.

This Article identifies “severance costs” and “adjustment failure costs” as the two primary criteria associated with market emergence, durability, and, ultimately, effectiveness. Severance costs are those costs associated with defining, enforcing, and transacting in marketable “goods.” Adjustment failure costs are the costs associated with the delays, misallocations, and pressures inherent in the iterative process of market pricing. The Article argues that severance costs and adjustment failure costs offer powerful insights for the appropriateness of market-based governance in the environmental context and beyond, because if these costs are too high they can outweigh the benefits of a market system.

After identifying the importance of severance costs and adjustment failure costs, the Article then assembles them into a framework. This model offers guidance for sorting, selecting, designing, and improving market-based programs. With the model, policymakers can not only assess whether market-based governance would be appropriate for particular resource contexts, but also choose which market-based approaches might be most likely to succeed. For instance, the model can identify conditions where specific market-based programs (such as cap-and-trade or Pigouvian-tax systems) are more- and less-likely to be effective. Practically speaking, this empowers policymakers with a diagnostic tool for environmental governance in scenarios ranging from nutrient pollution in the Chesapeake Bay, to allocation of western water rights, to preservation of endangered species habitats. Moreover, the model is also applicable to market-based governance in many other areas, such as transfers of human tissues or professional licensing regimes.

In addition to informing policy on a practical level, this analysis can also advance theoretical understandings of the commodification debate that has roiled law and the academy for decades. The same framework of severance costs and adjustment failure costs can inform and elucidate normative theories over which values should be commodified.

4. Some of this controversy revolves around issues of fraud, enforcement, and normative messages. See Victor B. Flatt, *Taking the Legislative Temperature: Which Federal Climate Change Legislative Proposal is “Best”?*, 102 NW. U. L. REV. COLLOQUY 123, 138 (2007).

5. For a broad critique of the normative appropriateness of cost benefit analysis and pricing of environmental and health amenities, see FRANK ACKERMAN & LISA HEINZERLING, PRICELESS: ON KNOWING THE PRICE OF EVERYTHING AND THE VALUE OF NOTHING (2004).

In sum, this Article makes two important contributions. First, it offers practical insights into the emergence, appropriateness, and design of market tools, which can be applied to governance of environmental resources, as well as to market instruments more broadly. Second, it adds to the literature on commodification by offering a positive economic framework that explains the existing laws and thinking regarding the limits of commodification.

The Article proceeds as follows: Part I discusses the background and context of market-based tools for environmental governance. It describes relevant environmental management approaches, including both market-based approaches and regulatory approaches. Part II then delineates the constituent parts of a model for assessing market emergence, appropriateness, and design. It identifies and describes “severance costs” and “adjustment failure costs” as the two underappreciated and primary dimensions that impact the emergence and success of market mechanisms, and it specifically addresses their applicability to the environmental context. Building on these insights, Part III constructs and applies a model, using a plot of severance costs and adjustment failure costs to describe and evaluate approaches to environmental governance. It also introduces broader implications of the model, particularly as applicable to markets for human tissues and licensure requirements for professions and platforms. Finally, Part IV examines the theoretical implications of the model, specifically in terms of how they inform thinking about non-commodification.

I. THE BACKGROUND AND CONTEXT FOR MARKET-BASED ENVIRONMENTAL GOVERNANCE

To provide background and context for considering the appropriateness and design of market-based environmental governance, this Part offers an overview of environmental management approaches. This situates market approaches within the menu of environmental management options. Additionally, by describing these management approaches, offering examples of their deployment, and discussing their benefits and drawbacks, this Part sets the stage for subsequent Parts, which build a model that can evaluate the desirability of each in context.

There are three main approaches to environmental management: “laissez-faire,” “command-and-control regulation,” and “market-based regulatory tools.”⁶ These different approaches roughly coincide with a chronological evolution of

6. Carol Rose created a taxonomy of environmental management in her seminal 1991 article *Rethinking Environmental Controls*, 1991 DUKE L.J. 1 (1991). She classified environmental management devices into “do-nothing,” “keepout,” “rightway,” and “property.” *Id.* at 9. Moral suasion was also discussed. *Id.* at 2, 31–34, 38. Her insights into environmental management and associated costs continue to be influential. Others have offered additional useful taxonomies of environmental governance. *See, e.g.*, James Salzman, *Teaching Policy Instrument Choice in Environmental Law: The Five P’s*, 23 DUKE ENVTL. L. & POL’Y F. 363 (2013). Here, however, we choose to use the terms “laissez-faire,” “command-and-control,” and “market-based regulatory tools,” which reflect the current debates in environmental regulation and terms related to markets generally.

environmental management, and so they are presented in that manner. However, the order is not to indicate that the more recent represent more highly evolved or necessarily more effective approaches.⁷

A. Laissez-Faire

A laissez-faire approach simply leaves environmental governance, such as the cleanliness of water, abundance of wildlife, or amount of undeveloped land, to market forces subject to general statutory or common law rules and enforcements of markets generally. Under a laissez-faire approach, there is little in terms of specific environmental regulation. Rather, environmental amenities are typically considered bound up in property (usually land) ownership; potentially held as property rights themselves (such as a right to harvest timber independent of land ownership); or considered as part of an individual right to be free from intentional interference. Under such an approach, any environmental governance would be the province of the rights holder, and legal protection would manifest through property or tort causes of action.

This approach was the most common state of affairs prior to the 1970s (which saw the advent of environmental protection statutes), and today some environmental issues continue in essentially a laissez-faire management structure. Prominent current examples of this laissez-faire approach include the emission of carbon dioxide and other greenhouse gases and the development of most privately-owned land.⁸

Proponents of a laissez-faire approach note that it can harness the power of the pricing system and lead to efficient, welfare-enhancing allocations of resources.⁹ They suggest that environmental protection should not be dictated from on high; rather, it should be subject to market tradeoffs and thus exist up to the level of market demand.¹⁰ Thus, the market would decide how to balance environmental values, such as the preservation of penguins, against other values, such as the production of washing machines.¹¹ Under such a framework, individuals who valued penguins would pay for penguin preservation through donating money, preserving habitat, or making other market choices to demonstrate their value of the penguins. There would be no additional protection of penguins other than what the “market” for penguin preservation yielded. In this way, penguins would be treated no differently than washing machines, which are only “preserved” in the

7. Rose believed that new management strategies emerged as resource pressures changed, thus altering the balance of differing costs. *See* Rose, *supra* note 6, at 14.

8. Assuming it is not regulated by some provision of a related environmental statute, such as the Clean Water Act, 33 U.S.C. §§ 1251–1387 (1995), or Endangered Species Act, 16 U.S.C. §§ 1531–1544 (1988).

9. *See, e.g.*, TERRY L. ANDERSON & DONALD R. LEAL, *FREE MARKET ENVIRONMENTALISM* (1991); WILLIAM F. BAXTER, *PEOPLE OR PENGUINS: THE CASE FOR OPTIMAL POLLUTION* (1974).

10. *See* BAXTER, *supra* note 9.

11. *Id.*

sense that people continue to pay money for them. The laissez-faire approach essentially asks individuals to demonstrate their preferences through their choices of where to spend money, whether on penguins or washing machines or other resources, and lets the chips fall where they may.

There are well-documented criticisms of the laissez-faire approach to environmental governance, and these are typically considered the primary arguments for environmental regulation.¹² A central feature of the criticisms is the issues of environmental externalities that stem from poorly defined or poorly enforced property rights.¹³ And, in fact, these externalities, along with commons problems, market failures, and a variety of other phenomena, have resulted in environmental degradation. Additionally, there are also those who suggest that environmental goods are too precious, too fragile, or too poorly understood to be left in the hands of the market.¹⁴ Moreover, there are arguments that avoiding interference with human health may also be considered some sort of common law right that is insufficiently protected in a laissez-faire system.¹⁵ Recognition of these criticisms, as well as the failure of property and tort law to provide adequate solutions, led to the establishment of most environmental regulations, particularly “command-and-control” approaches.

B. Command-and-Control Regulation

As a response to the environmental problems arising under the laissez-faire approach, legislatures enacted specific environmental statutes and regulations. This was the case in the 1970s, when most of the major federal environmental statutes were adopted.

A core feature of many of these statutes was a “command-and-control” approach to environmental management. This method of environmental governance typically relies on prescriptive regulation of the “thou shalt” or “thou shalt not” variety.¹⁶ Such regulations address externalities and commons problems through regulatory governance, such as setting emission limits, technology standards, or use parameters. Examples of command-and-control regulation include the Clean Water Act and Clean Air Act requirements of certain purification

12. See, e.g., ROBERT PERCIVAL ET AL., *ENVIRONMENTAL REGULATION: LAW, SCIENCE, AND POLICY* (4th ed. 2003).

13. See, e.g., MAXWELL L. STEARNS ET AL., *LAW AND ECONOMICS: PRIVATE AND PUBLIC* (2018). Proponents of a market system for environmental management answer this criticism by suggesting that a laissez-faire system could address and resolve these problems if property rights in environmental amenities could be better defined and enforced. See ANDERSON & LEAL, *supra* note 9. However, as discussed below, defining property rights may prove no simple task. See discussion *infra*.

14. This may be based on moral reservations, on opportunity concerns for future generations, or on concerns that there will be too steep an economic discounting of future costs versus present gains.

15. Victor B. Flatt, *This Land is Your Land (Our Right to the Environment)*, 107 W. VA. L. REV. 1 (2004).

16. See Salzman, *supra* note 6.

technologies for pollution and the Endangered Species Act's prohibition on actions adverse to protected species.¹⁷

Many of these early statutes either explicitly or implicitly (through the creation of limits) have also introduced a normative baseline of environmental protection that would be absent in a laissez-faire system. They do not let the market decide the tradeoff between protecting human health (or penguins) and producing washing machines. Rather they recognize a specific level of protection, such as, with respect to human health, not allowing any environmental pollution to have *any* effect on public health.¹⁸

This baseline-setting function reflects one of the major arguments for environmental regulation. Under a laissez-faire system, even an idealized one in which relevant property rights could be defined and enforced as to eliminate environmental externalities,¹⁹ there is no guarantee that markets will actually preserve any particular environmental goods. For example, nothing guarantees that the market will provide human health (or penguin) protection.

This is because the market system is a process, not an outcome, so it guarantees no normative baseline.²⁰ As one commentator put it, "the market order is something very different from a tool which is purposely made to serve chosen ends Since it does not 'aim' at any particular objectives, we cannot criticize it if some particular value that might be named is not in fact achieved by it."²¹ Or, more colloquially: "Capitalism does not produce justice, any more than knife fights do."²² Justice is simply not the aim of a market, nor is environmental preservation, nor is any other particular outcome. In fact, some schools of economics suggest that it may even be an oversimplification to say that a laissez-faire approach would lead to efficiency.²³ A functioning market process may guarantee information gathering,

17. See Endangered Species Act, 16 U.S.C. § 1538 (1988); Clean Water Act, 33 U.S.C. § 1311(b)(1) (1995); Clean Air Act, 42 U.S.C. § 7411(b) (1990).

18. Flatt, *supra* note 15, at 2; see 42 U.S.C. § 7409 (1977).

19. See discussion of free market environmentalism *supra* note 9.

20. James M. Buchanan, *Order Defined in the Process of its Emergence*, 5.4 LITERATURE OF LIBERTY 5-18 (1982), <https://www.econlib.org/library/Essays/LtrLbrty/bryRF1.html> [<https://perma.cc/MH4Q-N7K6>] (reviewing Norman Barry, *The Tradition of Spontaneous Order*, 5.2 LITERATURE OF LIBERTY 7 (1982)).

21. EAMONN BUTLER, HAYEK: HIS CONTRIBUTION TO THE POLITICAL AND ECONOMIC THOUGHT OF OUR TIME 44 (1985).

22. See Timothy Taylor, *Capitalism for Growth, Government [sic] for Fairness*, CONVERSABLE ECONOMIST (Nov. 27, 2015, 8:00 AM) (quoting Donald Kaul), <https://conversableeconomist.blogspot.com/2015/11/capitalism-for-growth-goverment-for.html> [<https://perma.cc/LX47-ZKA4>].

23. See, e.g., Israel M. Kirzner, *Entrepreneurial Discovery and the Competitive Market Process: An Austrian Approach*, 35 J. OF ECON. LITERATURE 60, 81 (1997), <http://econfaculty.gmu.edu/pboettke/summer/summer%20docs/kirzner1997.pdf> [<https://perma.cc/3VGZ-BVN5>] ("Austrian economics makes *no* claim that the market outcomes at any given date are efficient and socially optimal . . .") (emphasis in original).

knowledge acquisition, and price setting,²⁴ but it cannot guarantee environmental protection.²⁵ It is for this reason that many environmental laws, particularly command-and-control regulation, reflect an explicit unwillingness to accept the chance result or emergent order of markets and instead adopt a normative baseline of acceptable environmental conditions. To return to our example from above, the modern environmental statutes will not leave penguin protection to chance; they will dictate the level of penguin protection, regardless of the demand for washing machines.

Such mandates, however, come with their own costs and criticisms as well. Costs of the command-and-control approach include the costs of its administration and enforcement, the costs of compliance (including any inefficiencies therein), and the costs of resource losses due to imperfect enforcement.²⁶ Additionally, such regulatory regimes can result in static (even stagnant and outdated) regulations that offer little incentive for improvement, do not account for marginal utility among users, and do not have the benefits of a price mechanism to allocate resources.²⁷

Because command-and-control regimes are shaped by government actors, they also come with the baggage of politics and bureaucracy. Policymakers have various incentives for ossification, indecision and abdication of responsibility,²⁸ and private entities have incentives to engage in rent seeking to secure more favorable regulatory standards.²⁹ Scientific uncertainty can additionally exacerbate these problems by leaving wiggle room for interest groups to shape policies.³⁰

So, though command-and-control approaches have the ability to set normative baselines of environmental protection, one might rightly ask whether political institutions will do a good job in setting such baselines, particularly as mediated through use restrictions (as opposed to a specific normative decision). While too much emphasis on rent seeking can reduce one to nihilism,³¹ and while political institutions can sometimes actually be responsive and representative,³² a rigorous evaluation of environmental management approaches must consider the

24. See, e.g., F.A. HAYEK, *THE FATAL CONCEIT: THE ERRORS OF SOCIALISM* (1988), reprinted in 1 *THE COLLECTED WORKS OF F.A. HAYEK* 11–28 (W. W. Bartley III ed., 1988).

25. Cf. Justin R. Pidot, *Governance and Uncertainty*, 37 *CARDOZO L. REV.* 113, 163–64 (2015) (“The importance of achieving resource protection is sometimes overlooked by advocates of adaptive regulation, who occasionally act more like scientists than policy experts . . . Adaptive regulation, then, may threaten to substitute the goals of scientific inquiry for the goals of governance.”).

26. Victor B. Flatt, *Saving the Lost Sheep: Bringing Environmental Values Back into the Fold with a New EPA Decisionmaking Paradigm*, 74 *WASH. L. REV.* 1 (1999).

27. See Salzman, *supra* note 6.

28. See MAXWELL L. STEARNS & TODD J. ZYWICKI, *PUBLIC CHOICE CONCEPTS AND APPLICATIONS IN LAW* 358 (2009).

29. *Id.*

30. See, e.g., Amy Sinden, *In Defense of Absolutes: Combating the Politics of Power in Environmental Law*, 90 *IOWA L. REV.* 1405, 1489 n.365 (2005).

31. See STEARNS & ZYWICKI, *supra* note 28.

32. See Arthur T. Denzau & Michael C. Munger, *Legislators and Interest Groups: How Unorganized Interests get Represented*, 80 *AM. POL. SCI. REV.* 89 (1986).

real world. Thus, it must weigh how the imperfect reality of command-and-control regulation measures up against the imperfect reality of other approaches.

C. Market-Based Regulatory Tools

Offering something of a hybrid between laissez-faire markets and command-and-control regulation are “market-based regulatory tools.” As discussed in more detail below, these tools harness market forces, such as pricing mechanisms, property rights, and economic incentives, but they do so in the context of a regulatory structure, often with a predetermined normative baseline of environmental protection. Though market-based tools are not necessarily new,³³ they have become increasingly popular over the last three decades as a darling approach for innovative environmental governance.³⁴

Market-based regulatory tools begin with some regulatory scheme that creates the underlying market conditions. Though neoclassical economics has suggested that markets form naturally,³⁵ today’s scholarship often emphasizes the role of government and law in providing the security needed for markets to function.³⁶ Central to this role of law is the definition of property rights and rules of exchange.³⁷

Many environmental interests have historically not been considered property or subject to market economics. This is because the environmental amenity may be considered as something owned by all, such as with the public trust doctrine,³⁸ or because disagreement over legal entitlements to the amenity may not allow the clear definition of a property- or other-rights- boundary.³⁹

While property interests may exist for some environmental or resource amenities (such as private grazing lands), many, if not most, market-based strategies for environmental protection depend on the government to define or create a property interest so that resources that do not naturally come in markets (such as clean air) can be valued and the subject of commerce. These property interests “may be created by legal fiat as in Pigouvian taxes or cap-and-trade systems, or they may

33. Taxes were proposed as a strategy to control environmental pollution as early as 1968. *See* [Air Pollution Control Act], Act No. 97 of 1968, *amended by* Act No. 41 of 2015, art. 1. Market mechanisms were employed by the EPA for air pollution as early as the 1970s. Tyler McNish, *Carbon Offsets Are a Bridge Too Far in the Tradable Property Rights Revolution*, 36 HARV. ENVTL. L. REV. 387, 397 (2012).

34. Don Bradford Hardin, Jr., *Why Cost-Benefit Analysis? A Question (and Some Answers) About the Legal Academy*, 59 ALA. L. REV. 1135 (2008).

35. Harold Demsetz, *Toward a Theory of Property Rights*, 57 AM. ECON. REV. 347 (1967).

36. *See* Okezie Chukwumerije, *Rhetoric Versus Reality: The Link Between the Rule of Law and Economic Development*, 23 EMORY INT’L L. REV. 383, 397 (2009); Eric W. Orts, *The Complexity and Legitimacy of Corporate Law*, 50 WASH. & LEE L. REV. 1565, 1581 (1993); David M. Trubek, *Toward a Social Theory of Law: An Essay on the Study of Law and Development*, 82 YALE L. J. 1, 6 (1972).

37. Abraham Bell & Gideon Parchomovsky, *A Theory of Property*, 90 CORNELL L. REV. 531, 533 (2005).

38. *See* THOMAS W. MERRILL & HENRY E. SMITH, PROPERTY: PRINCIPLES AND POLICIES (Robert C. Clark et al. eds., 3d ed. 2015).

39. *See, e.g.,* *Boomer v. Atl. Cement Co.*, 257 N.E.2d 870 (N.Y. 1970).

arise organically or with regulatory assistance” when resources become scarce due to government action or law (such as developable land in an endangered species habitat).⁴⁰

This government action results in a new valuable property right (such as a “right to pollute”) or in an additional market value for existing property because of a newly defined environmental amenity (such as habitat or pollution control).⁴¹ In order for market-based strategies to operate, there must be a demand for an amenity or right for which someone will spend valuable resources. If there is no shortage of amenities or no demand for rights, there will be no market-based control strategy.⁴²

Much of environmental law in pollution control involves the establishment of health-based targets for pollution levels, and the market and property mechanisms created by government can become the tool (or one of the tools) used to try to implement that target. Market mechanisms have been employed by the EPA in air pollution contexts as early as the 1970s.⁴³ EPA embraced the use of wetlands mitigation banks in 1995,⁴⁴ and market provisions were enshrined statutorily in the acid rain control provisions of the 1990 Amendments to the Clean Air Act.⁴⁵

Overall, such market-based environmental regulatory tools typically take the form of either pricing programs (also known as Pigouvian taxes) or cap-and-trade programs, both of which are examined in more detail below.

1. Pricing Programs

Pricing programs (or Pigouvian taxes) are policy measures aimed at influencing behavior (often reducing seemingly excessive or unwanted behavior or at least internalizing the costs of such behavior) by attaching an increased cost to the behavior. In the environmental context, pricing programs add a cost (i.e. tax) to the use of an environmental good. This cost then impacts the use of this environmental good, typically causing use to go down as the price goes up and dampens demand.⁴⁶ Thus, rather than prescribing a specific limit on resource use (e.g., no more than X tons, as a command-and-control regulation might mandate), pricing programs rely on market forces to limit resource use and force resource users to internalize costs that might otherwise be externalized. At the individual level, pricing programs can be more precise than command-and-control regulations because they allow for

40. Victor B. Flatt, *Market-Based Control Strategies*, in 2 DECISION MAKING IN ENVIRONMENTAL LAW 176 (LeRoy C. Paddock et al. eds., 2016) (Edward Elgar, Encyclopedia of Environmental Law Series).

41. James Salzman & J.B. Ruhl, *Currencies and the Commodification of Environmental Law*, 53 STAN. L. REV. 607, 617 (2000).

42. Flatt, *supra* note 40, at 177.

43. McNish, *supra* note 33, at 397.

44. Gail L. Achterman & Robert Mauger, *The State and Regional Role in Developing Ecosystem Service Markets*, 20 DUKE ENVTL. L. & POL'Y F. 291, 306 (2010).

45. McNish, *supra* note 33, at 398.

46. Decreasing resource use assumes an elasticity of demand. If demand is inelastic, then the increased price will not decrease demand, but rather will raise revenue as individuals pay the tax.

individual resource users to more precisely consider the marginal utility of their use levels. Further, at least in theory, at the broader level prices can be set to encourage a societally-optimal level of activity (e.g., to strike a chosen balance between production and carbon emission).

For example, a hypothetical Pigouvian tax on carbon emissions, a “carbon tax,” could assign a cost of \$100 to emit a unit of carbon. Under such a carbon tax program, any entity (say Firm A, Firm B, Firm C, and so on) could emit as much carbon as it cared to, provided that it paid \$100 per unit. This tax would force entities to internalize some⁴⁷ of the cost of the otherwise free carbon emissions, forcing each emitter to consider whether its emissions were worth the cost.

Unlike the blunt dictate of a command-and-control emission limit, this tax would send a more nuanced market signal to carbon emitters. Some emitters (presumably lower-value ones) would decrease or stop emitting carbon altogether if their products are no longer worth producing after internalizing their carbon cost. Other entities (presumably higher-value producers) would find it worthwhile to continue producing in the amount that fills demand for their product, even having internalized their carbon cost. Unlike a one-size carbon limit, this pricing program would allow individual producers to more closely tailor carbon emission to the demand for their product, and all entities would have incentive to innovate and find cheaper alternatives to carbon emission.

All pricing programs rely on this dynamic, and in addition to proposed carbon taxes, other examples of pricing programs include gasoline taxes, runoff charges, water consumption pricing, and even permit programs (if permits are granted as a matter of course).⁴⁸

The major criticism of pricing programs arises from the difficulty of actually setting prices. While Pigouvian taxes may be theoretically elegant, translating them into practice is a tall order. In particular, both knowledge limitations and political forces pose major challenges for policymakers seeking to optimally set prices.

In terms of knowledge limitations, first, scientific uncertainty surrounding many environmental conditions makes it difficult to gauge an ideal level of resource use to begin with, so picking a normative baseline to aim for is itself challenging, even if one knew exactly how prices would impact levels of resource use.

Second, and applicable to Pigouvian taxes beyond the environmental context, setting an optimal level of price is a difficult undertaking because it requires near omniscience regarding dynamic conditions and actors. No one individual knows

47. How much of the cost is internalized depends on how high the price is set. For discussion of the difficulties in price setting, see the discussion *infra*.

48. There can be crossover between command-and-control approaches and price setting. For example, in permit programs where permits are granted as a matter of course, the cost of a permit is essentially just a tax. Similarly, as discussed below, there can be crossover between cap-and trade programs and pricing programs when caps are not strictly enforced. See the discussion below for more detail.

with certainty how a given price will impact levels of resource use among varied entities at a single point in time, much less in constantly changing contexts of production and innovation. The unplanned market process inherently aggregates such information and adjusts prices accordingly, but price-planners do not have the benefit of the dispersed knowledge-gathering function of the market.⁴⁹ Based on these dynamics, there is a well-documented literature on the difficulty of setting Pigouvian tax levels.⁵⁰ Indeed, private firms too face a knowledge limit in setting prices for new goods,⁵¹ but for private firms there is not so great a pressure on the initial price setting because firms can more easily adjust prices in response to market signals. With government price setting, however, the legislative or administrative processes necessary to adjust prices mean that any price change will likely be relatively slow⁵² (and, as discussed below, political pressures may make them slower still).⁵³ This compounds the difficulty of initial price setting because slower adjustment puts added pressure to get pricing right the first time.

In addition to the knowledge-based challenges of setting prices, there are also political complications that build on these knowledge limitations. For example, rent seeking can lead to pricing decisions made not only on the best possible information but also based on the ability of interested parties to effectively lobby. Any uncertainty regarding science or pricing levels offers additional ammunition for rent seekers to pursue a more favorable outcome.⁵⁴ Further, while there may be interest groups lobbying both sides of an issue, history also indicates that prices for environmental goods are more likely to be set too low rather than too high, which risks unidirectional errors in overuse of resources.⁵⁵ Moreover, price setting creates incentives for continuous rent seeking because even after pricing is imposed, entities subject to the pricing system are likely to continue lobbying to decrease the tax, and entities favoring lower resource use may continue lobbying to increase the tax.⁵⁶ While these opposing lobbying forces, as well as other bureaucratic incentives,⁵⁷ may insulate the price from changing most of the time, prices remain politically up for grabs, risking continual deadweight loss from rent seeking.⁵⁸ Additionally, this puts a great deal of pressure on the initial price setting because it may be difficult

49. See HAYEK, *supra* note 24, at 66–88.

50. See STEARNS & ZYWICKI, *supra* note 28.

51. See, e.g., Jerry A. Hausman, *Valuation of New Goods Under Perfect and Imperfect Competition*, in THE ECONOMICS OF NEW GOODS 209 (Timothy F. Bresnahan & Robert J. Gordon eds., 1996).

52. This slow change in pricing can add to adjustment failure costs, which are discussed *infra*.

53. The slower reaction time may be considered a partial positive if one is worried about insulating against market swings, but the political delay also means missing out on the values of market corrections and the potential efficiency gains of the market process.

54. See Flatt, *supra* note 26, at 7.

55. For additional discussion of unidirectional error, see discussion *infra*.

56. Victor B. Flatt, “Offsetting” Crisis?—Climate Change Cap-and-Trade Need Not Contribute to Another Financial Meltdown, 39 PEPP. L. REV. 619, 628 (2012).

57. See STEARNS & ZYWICKI, *supra* note 28.

58. Flatt, *supra* note 26, at 6–8.

to adjust the already-difficult endeavor of price setting to create a normative baseline of resource use.

Taken together, these criticisms show that pricing programs will not necessarily ensure a normative baseline for environmental protection. They will only be effective if prices are set at a sufficient level to protect resources, and that is a challenging proposition. Knowledge limitations and political pressures add to the challenges of setting such a level.

2. *Cap-and-Trade*

As an alternative to price setting, cap-and-trade programs are market-based tools that function by controlling supply. Cap-and-trade systems are built around regulatory measures that limit (i.e. “cap”) certain activities or resource uses. Under the cap, different entities receive allowances (often termed credits) for a defined amount of activity or resource use. Entities can then either use or transfer allowances (i.e. “trade”) to suit their needs and values.⁵⁹

For example, a hypothetical cap-and-trade program for carbon emissions would first impose a limit on total carbon emissions. For simplicity, assume a hypothetical cap of 100 units. Then, under that cap the program would assign allowances. Again, for simplicity, imagine that Firm A receives an allowance to emit 2 units and Firm B receives an allowance to emit 3 units. At this point, Firm A and Firm B could use their respective allowances to emit carbon or could trade their allowances. For example, if Firm A, with its allowance of 2 units, decided to emit only 1 unit, then it would have 1 unit left to sell to Firm B. If this occurred, then Firm A would be left with 1 unit of allowance, and Firm B would now hold 4 units of allowance. Countless other scenarios are also possible, such as Firm B buying all of Firm A’s allowances, Firm C entering the market by buying allowances, or an environmental group buying allowances just to retire them. Thus, under a cap-and-trade system, the allocation of allowances can function just like any other market once the cap is imposed and the allowances are initially distributed.

The Sulphur Dioxide market under the Clean Air Act offers an example of a cap-and-trade program in practice.⁶⁰ Additionally, the Clean Water Act’s section 404(b) program regulating wetlands imposes a cap-and-trade system (albeit an imperfect one, as discussed below). It sets a cap of “no net loss of wetlands,” and through mitigation efforts it essentially allows trading of wetlands credits.⁶¹ Finally, cap-and-trade systems have even arisen in the context of the Endangered Species Act. The Endangered Species Act protects listed species found to be in danger of extinction, and though the listing process is supposed to disregard economic factors,

59. See, e.g., Nathaniel Keohane, *How Cap and Trade Works*, ENVTL. DEF. FUND, <https://www.edf.org/climate/how-cap-and-trade-works> [https://perma.cc/S6VX-VNGV] (last visited Feb. 5, 2019).

60. See 42 U.S.C. § 7651(b) (2012).

61. See discussion *infra*.

recent listing decisions have looked to private conservation efforts (such as private protections for species habitat) to influence listing decisions.⁶² Functionally, this forms another sort of cap-and-trade market for endangered species habitats because trades of habitat protection can be used as offsets to preserve a minimum species population (and thereby prevent regulatory burdens).

As with price setting, cap-and-trade systems have the benefit of harnessing economic incentives. Like pricing systems, cap-and-trade programs allow entities to tailor their resource use based on marginal utility while creating incentives for improving efficiency and discovering less expensive alternatives. Additionally, cap-and-trade programs may present an advantage over pricing programs because cap-and-trade systems do not require price setting by the government. Once a cap is set, the market works to set and adjust prices based on supply and demand. Moreover, unlike pricing systems, which do not necessarily impose a normative baseline of environmental protection, cap-and-trade programs provide a definite normative baseline for resource use: the cap.

As cap-and-trade systems revolve so fundamentally around the cap, the primary challenge of deploying such systems is in setting and enforcing such a cap. As with price setting, this raises issues of knowledge limitations and political pressures, albeit slightly different ones. In terms of knowledge limitations, cap-and-trade systems necessitate the complexity of calculating a meaningful cap in the context of scientific uncertainty and subject to the challenges of defining, allocating, and enforcing the entitlements under that cap.⁶³ This may still be less perplexing than price setting, because setting a cap requires only identification of a desired level of resource use,⁶⁴ whereas price setting requires not only identifying a desired level of resource use but also then calculating a price likely to bring about that level of use. Nonetheless, setting a cap alone is no small feat.

In terms of political pressures, cap-and-trade programs can be susceptible, at least initially, to the same rent seeking behavior that is likely to impact price setting. Moreover, cap setting is likely subject to the same unidirectional error that can result in caps being systematically set on the generous (i.e., less protective) end.⁶⁵

Additionally, even after caps are set, there is the challenge of retaining a “hard cap” that stands firm against pressures to loosen limits and allow more resource use.⁶⁶ Political incentives often push legislators to relax hard lines, whether with budgets or caps, especially when the squeeze is felt immediately but the benefits do not manifest within an election cycle. As a result, it may be politically difficult to

62. Achterman & Mauger, *supra* note 44, at 305.

63. As discussed below, these are all examples of severance costs.

64. *Cf.* Flatt, *supra* note 26, at 20–21.

65. See the discussion above for more detail. See generally Lesley K. McAllister, *The Overallocation Problem in Cap-and-Trade: Moving Toward Stringency*, 34 COLUM. J. ENVTL. L. 395 (2009).

66. See Michael Pappas, *A Right to Be Regulated?*, 24 GEO. MASON L. REV. 99, 134 (2016) (discussing building height limits as an example of a cap-and-trade program in which the cap has been relaxed); *cf.* Bruce R. Huber, *The Durability of Private Claims to Public Property*, 102 GEO. L.J. 991 (2014) (discussing political compromises extending the length of private claims to public property).

maintain hard caps if the price becomes high and there is not a large constituency to protect the cap.⁶⁷

The experience with the Clean Water Act's section 404(b) wetlands program demonstrates just such a phenomenon. Though the program nominally sets a cap of "no net loss of wetlands," political pressures have led to an erosion of this baseline, making it a "soft cap" rather than a hard cap. For example, development interests frequently complain that permitting decisions are too costly, politicize wetlands permitting decisions, and raise the political stakes of permit denials. As a result, the "no net loss of wetlands" cap has been loosened both *de facto* and *de jure*. Permits are frequently granted as a matter of course, and the Army Corps of Engineers (the permit granting authority) views its mission as granting permits rather than denying them.⁶⁸ Additionally, political decision-making has undermined the cap *de jure* by expanding the definition of wetlands (for example, by counting golf-course water hazards as wetlands), and administering mitigation programs that have allowed cash payments as offsets to wetland destruction.⁶⁹

Once a cap is loosened in such a way (either by legislative action or a lack of enforcement), it runs the risk that the supply limitation will be so undermined that, at best, the "soft" cap-and-trade system just becomes a pricing system (or tax) that does not ensure a normative outcome.⁷⁰ That is, people may pay to buy credits (or offsets, or allowances), but there is no true baseline of actual environmental protection.⁷¹ This is the state of the Clean Water Act section 404(b) wetlands program, and it has been a criticism of other offset programs as well.⁷²

Thus, a functional cap-and-trade system requires a hard cap, and fortunately there are institutional and structural designs that can help increase the likelihood of preserving a hard cap. Obviously, if there is a sufficient constituency in support of a hard cap, that will help offer political cover to protect the cap, and to some degree, a relatively robust cap-and-trade market will ensure such a constituency. Under a functioning cap-and-trade regime, the allowance holders will have an incentive to

67. Moreover, if a cap-and-trade system exists, but trades do not actually occur, there is a risk that the whole regulatory structure falls apart because individuals seek relief from the cap. For example, if a sufficiently powerful set of interest holders protest, it is now "too expensive" to do business. Therefore, the promised efficiency reductions from trades are not occurring (possibly because of high severance costs), and that too may lead to an ultimate relaxation or elimination of the cap.

68. See *Much Ado About Nothing*, ENVTL. WORKING GRP. (Apr. 1, 1995), <https://www.ewg.org/research/much-ado-about-nothing#.Wn5qpbbMwWo> [<https://perma.cc/BK5W-3XMA>].

69. See *Section 404 of the Clean Water Act: Compensatory Mitigation*, EPA, <https://www.epa.gov/cwa-404/compensatory-mitigation> [<https://perma.cc/VJ7S-R5HU>] (last updated Oct. 4, 2018); *Section 404 of the Clean Water Act: Compensatory Mitigation Mechanisms*, EPA, <https://www.epa.gov/cwa-404/compensatory-mitigation-mechanisms> [<https://perma.cc/TC5R-5ULA>] (last updated Dec. 6, 2017) (describing in-lieu fee programs).

70. Not only would such a system not assure a normative outcome, but likely the pricing will be lower than it would have been if designed as a pricing system in the first instance. Among other reasons, this is because there will be no attempt at price planning, and the relatively unlimited supply of "credits" will drive the price of credits down.

71. This criticism takes another form in the "leakage" analysis of cap-and-trade programs.

72. See discussion of REDD *infra* p. 774.

preserve the integrity of the system.⁷³ Thus, there may be private market pressures to maintain (or even tighten) these caps over time. Moreover, if credits in a cap-and-trade program are considered property protected by the Fifth Amendment Takings Clause, this can help protect the constituency of allowance holders and make it more expensive for legislators to soften a cap, thereby helping bind political hands to the mast of a hard cap.⁷⁴

II. COSTS IMPACTING THE EMERGENCE AND SUCCESS OF MARKET MECHANISMS

There are challenges in creating complex institutions in general and in markets in particular. This Part addresses the role of underappreciated costs in impeding the formation and success of markets, particularly for certain environmental “goods.” While some of these concepts have been discussed in previous literature, this Part identifies additional important considerations and aggregates this thinking into an overarching explanation of why certain markets may not emerge and remain difficult to create.

First, Section A draws upon the insights and legacies⁷⁵ of economists Friedrich Hayek, James Buchanan, Elinor Ostrom, Ronald Coase, and Harold Demsetz to suggest that attempts to create complex institutions, like markets, should be approached with a healthy caution. Further, it applies their work to argue that the fact that markets have not emerged in certain areas may indicate that such markets would be inefficient because the costs of establishing the markets outweigh their benefits.

Following on this observation, Sections B and C then discuss two core sets of costs that influence market emergence and success: “severance costs” and “adjustment failure costs.” Specifically, Section B examines severance costs, which are the costs associated with defining, enforcing, and transacting in marketable “goods.” To pluck an environmental good from its interconnected ecological and legal context and to attempt to define it as a severable, stand-alone commodity can be costly. Additionally, when such an environmental good is not necessarily associated with tangible, physical ownership or when it has not historically been commodified, further challenges arise in creating the complex institutions necessary for such markets to function. If severance costs are too high, property interests may never be defined or transactions may never occur.

Section C then addresses adjustment failure costs inherent to the pricing system. In all markets, pricing results from an iterative trial-and-error process, and

73. Flatt, *supra* note 56, at 628.

74. See Christopher Serkin, *Public Entrenchment Through Private Law: Binding Local Governments*, 78 U. CHI. L. REV. 879 (2011) (discussing taking protections as a binding mechanism). *But see* Pappas, *supra* note 4 (discussing how many allowances in cap-and-trade programs are not protected by the Fifth Amendment Takings Clause).

75. This includes the schools of thought associated with some of these figures, including Austrian Economics, The Virginia School of Public Choice, and The Bloomington School.

it takes time (and misallocations) for supply and demand to align (assuming they ever do). The adjustment failure costs associated with such pricing delays and corrections may be trivial in some markets, but they can be particularly high and material in the context of non-fungible or irreparable goods. Since environmental goods in particular may display such non-fungible or irreparable characteristics, consideration of adjustment failure costs is crucial because high adjustment failure costs may exceed the potential gains of the market system. Thus, the adjustment failure costs that arise from the iterative function of markets represent another key factor in the emergence and success of markets.

A. The Difficulty of Creating Complex Systems and the Impact of Costs on Market Emergence

Hayek famously quipped: “The curious task of economics is to demonstrate to men how little they really know about what they imagine they can design.”⁷⁶ The criticism was aimed mainly at socialist attempts at centrally planned economies, but the sentiment holds broad applicability. It is extraordinarily difficult to understand, much less plan or create, a complex system, be that a market system, a nation, or a biological ecosystem. Accordingly, a healthy caution is appropriate when considering attempts to create or design markets (or even institutions pre-constituent to markets, such as property rights) where they have not previously existed.

However, with a disturbing frequency, such bold creationism has been taken as the blueprint for market mechanisms in environmental contexts.⁷⁷ For example, the creed of “establish property rights and let the rest sort itself out,” (which is essentially a simplified version of Garrett Hardin’s solution to the “tragedy of the commons” problem) is often seen as the model for environmental market solutions. However, there are important complications to consider, and establishing property rights is not simply a matter of declaration. As Ostrom observed, “theoretical predictions of the destruction of natural resources due to the lack of recognized property systems have led to one-size-fits-all recommendations . . . that frequently fail.”⁷⁸

Institutions such as property systems neither arise overnight nor are easily made from scratch. In fact, commentators have argued that there is little ability to

76. HAYEK, *supra* note 24, at 76.

77. More concerning still, some environmental market schemes are even more daring in their creationism. For example, some double-down and portend to create two complex systems simultaneously, attempting to establish markets for environmental goods that rely on the creation of ecosystems. Wetlands mitigation programs offer an infamous example.

78. Elinor Ostrom, *A General Framework for Analyzing Sustainability of Social-Ecological Systems*, 325 SCI. 419, 419 (2009).

suddenly “create” institutions at all, but rather they must “emerge” from a combination of culture, norms, historical contexts, and fortuitous actions.⁷⁹

Markets are a primary example of such institutions that may emerge but are difficult to create. For example, Hayek, who devoted considerable thought to institutional development and market order, posited that markets “resulted *not from human design or intention but spontaneously . . .* by means of an evolutionary selection.”⁸⁰ Hayek further considered markets to be “one of many systems which man has learnt to use . . . after he *stumbled on it without understanding it*. He did not design an economy and then select the price system as a way of coordinating it; his *fortunate discovery* facilitated the expansion of a complex and widespread economic system.”⁸¹ Similarly, Buchanan noted that with the appropriate foundations (discussed below), “markets will *emerge more or less spontaneously* out of the self-interested behavior of individuals, and the results will be beneficial to all members of the community.”⁸²

Not only do these economists consider markets to be emergent, but they also consider them to be hard to build and hard to steer. For example, Hayek reflected on planners’ abilities to influence markets as follows:

[The market] order, although far from perfect and often inefficient, can extend farther than any order men could create by deliberately putting countless elements into selected “appropriate” places. Most defects and inefficiencies of such spontaneous orders result from attempting to interfere with or to prevent their mechanisms from operating, or to improve the details of their results. Such attempts to intervene in spontaneous order rarely result in anything closely corresponding to men’s wishes, since these orders are determined by more particular facts than any such intervening agency can know.⁸³

In the same vein, Ostrom warned of attempts by outside planners to impose rules on emergent systems of order.⁸⁴ The upshot of these collected insights is that attempting to conjure markets on demand is an exceedingly difficult proposition.

79. See generally ERIC ALSTON ET AL., INSTITUTIONAL AND ORGANIZATIONAL ANALYSIS: CONCEPTS AND APPLICATIONS (Marguerite Dupree et al. eds., 2018) (noting the importance of each of these factors in the process of creating institutions).

80. HAYEK, *supra* note 24, at 6 (emphasis added).

81. BUTLER, *supra* note 21, at 51 (citing FRIEDRICH HAYEK, INDIVIDUALISM AND ECONOMIC ORDER 88 (1948)) (emphasis added).

82. JAMES M. BUCHANAN, THE LIMITS OF LIBERTY: BETWEEN ANARCHY AND LEVIATHAN 36 (1975). Such self-interested reaction could come from technological or values innovations, and may also push legal changes as well, particularly when the economic gains are great and the powerful group is not relatively disadvantaged. See Flatt, *supra* note 15, at 14–15.

83. HAYEK, *supra* note 24, at 84.

84. See *Economic Governance: The Organization of Cooperation*, ROYAL SWEDISH ACAD. SCI. (2009), <https://www.nobelprize.org/uploads/2018/06/popular-economicsciences2009.pdf> [<https://perma.cc/B23E-AFHK>]; see also Peter Boettke et al., *Riding in Cars with Boys: Elinor Ostrom’s Adventures with the Police*, 9 J. INSTITUTIONAL ECON. 407, 421 (2013).

Moreover, attempts to build complex institutions in other contexts demonstrate similar challenges and teach the same lessons of humility. For instance, attempts at “development economics” and “nation building” have rarely succeeded. Such complex systems may emerge, but they defy attempts at creation by fiat. For example, development-economics attempts to import market systems to other cultures have been marked by a “long history of ineffective efforts.”⁸⁵ As commentators have observed, development-economics measures that are focused on merely imposing market policies are unlikely to work.⁸⁶ Rather, market systems tend to emerge from a fortuitous mix of underlying institutions.⁸⁷ Unfortunately, we do not seem to know exactly the right mix of institutions, and even if we did, those institutions would likely prove difficult to change.

There are similar lessons in military and foreign policy operations aimed at “nation building,” which have come in for criticism that “outsiders can never build nations, if that means creating or repairing all the cultural, social, and historical ties that bind people together as a nation.”⁸⁸ Indeed, efforts to secure foreign areas and unpack a “government-in-a-box” (as colorfully predicted by one United States General) have tended to end unsuccessfully.⁸⁹

Finally, and particularly important to the context of this paper, attempts to create ecosystems have failed similarly to other attempts at creating a complex system. Efforts to create wetlands and streams or build prairies have been ineffective.

85. See also ELINOR OSTROM ET AL., *Preface to AID, INCENTIVES, AND SUSTAINABILITY 3* (2001), <https://www.oecd.org/derec/sweden/37356956.pdf> [<https://perma.cc/F8AD-L8K3>].

86. See, e.g., John Williamson, *What Should the World Bank Think About the Washington Consensus?*, 15 WORLD BANK RES. OBSERVER 251, 257 (2000), <https://documents.worldbank.org/curated/en/624291468152712936/pdf/766500JRN0WBRO00Box374385B00PUBLIC0.pdf> [<https://perma.cc/MKM4-B7DQ>] (“The popular, or populist, interpretation of the Washington Consensus, meaning market fundamentalism or neoliberalism, refers to laissez-faire Reaganomics—let’s bash the state, the markets will resolve everything. I would not subscribe to the view that such policies offer an effective agenda for reducing poverty. We know that poverty reduction demands efforts to build the human capital of the poor, but the populist interpretation fails to address that issue.”); see Nancy Birdsall et al., *The Washington Consensus: Assessing a Damaged Brand* (The World Bank Office of the Chief Economist: Latin America and Caribbean Region & Center for Global Development, Working Paper No. 5316, 2010), <https://documents.worldbank.org/curated/en/848411468156560921/pdf/WPS5316.pdf> [<https://perma.cc/3HV3-ZGRZ>] (providing additional criticism of economic development planning).

87. For example, in *How the West Grew Rich: The Economic Transformation of the Industrial World*, scholars argue that it is the pluralistic and flexible nature of the institutions in the West that allowed for its development, but it is difficult to reverse-engineer this set of institutions or export them. Alternatively, Max Weber, the famous German economist and sociologist, considered the question of why Capitalism did not develop in China, and he ultimately attributed it to religious institutions. See generally, MAX WEBER, *THE RELIGION OF CHINA: CONFUCIANISM AND TAOISM* (HANS H. GERTH ED., TRANS., 1951).

88. See Francis Fukuyama, *Nation-Building 101*, ATLANTIC (Jan./Feb. 2004), <https://www.theatlantic.com/magazine/archive/2004/01/nation-building-101/302862/> [<https://perma.cc/K32Z-HAB3>].

89. See *More Than a One-Man Problem*, ECONOMIST (Jun. 24, 2010), <https://www.economist.com/node/16425992> [<https://perma.cc/4CVA-QQ3H>].

With each of these complex systems, policymakers can identify constituent parts. Democracies are built on rule of law and free elections. Wetlands are based on water-and-land interfaces. Prairies are made of soil and grass and sunlight. However, listing those basic components does not add up to creating these environments. Identifying constituent parts is not the same as writing a recipe.

There is the potential for a similar failure in trying to create markets based on a checklist of ingredients. Speaking generally, Buchanan identified the foundations of markets as “individual rights . . . well defined and mutually accepted by all parties.”⁹⁰ He surmised that under such conditions “persons will be motivated voluntarily to initiate trades” and thereby establish markets.⁹¹ However, the existence of “individual rights . . . well defined and mutually accepted by all parties” is bound up in the complexities of background institutions and systems. When it comes to creating such complex systems and institutions that lead to markets, there appears to be a *je ne sais quoi*, and it is difficult to reproduce *je ne sais quoi*. When markets have not arisen, it is hard to expect that this *je ne sais quoi* will arise at a simple command.

While it is hard to list and create all the necessities for markets to emerge and succeed, it is much easier to identify factors likely to impede and stifle markets. Further, despite its seeming pessimism, the study of barriers to market emergence can inform (either by discouraging or marginally improving) efforts to encourage market formation. With such a goal in mind, this Section now considers such barriers, beginning with a combination of the insights of Demsetz and Coase that offer a descriptive lens for assessing why some markets may arise and lead to trades while others might not.

Influential works by Demsetz and Coase suggest that markets will emerge when it is efficient for them to do so. By extension, this suggests that instances where markets have not emerged (or have been encouraged but have not taken off) indicate that establishment of such markets would be inefficient. This observation begins with one of Demsetz’s key insights: that property rights will emerge when defining and enforcing them is worthwhile. That is, property rights will emerge when the value derived from the rights exceeds the cost of defining and enforcing them. One may add to this one of Coase’s core observations: that trades will occur (bringing property to its most-valued use regardless of initial allocations) if transaction costs are sufficiently low that the trades are worthwhile despite the transaction costs. That is, trades will occur when the value of the trade exceeds the cost in executing it. Combining these insights suggests that markets (i.e., institutions that involve trades of property rights) will emerge when the value of these markets exceeds the costs associated with establishing them (i.e., the costs of defining and enforcing property rights and the costs of executing trades). If this is the case, then instances where markets have not emerged or trades have not taken place suggest

90. BUCHANAN, *supra* note 82, at 36.

91. *Id.*

that some costs, either in establishing property rights or executing transactions, outweigh the value of the market transactions.⁹²

In light of this observation, it becomes important to consider these costs that impede market formation and success, particularly if one is attempting to establish a market mechanism for environmental governance or otherwise. While some such costs may be unavoidable, identifying the costs can shed light on when market instruments may be viable and, possibly, can lead to marginal cost reductions that increase the success of market instruments. This Article does not seek to list and evaluate all the possible costs that could hamper the emergence of market mechanisms, but it does emphasize two particular sets of costs that are both core to market success in the environmental and resource arena. The first set of costs, which we call “severance costs,” involve the problems of defining and enforcing rights to goods that are distinct and severed from other intertwined rights and values. Often called “standardization costs” in markets generally, Section B will address these. The second set of costs, often overlooked, we refer to as “adjustment failure costs”: the costs that occur in the time that the market fails to reach *pareto* optimal efficiency.⁹³ These costs involve both direct inefficiencies and the opportunity costs associated with the pricing system. Those will be discussed in Section C. Attention to these costs helps in evaluating whether market tools are appropriate in certain contexts, and in instances where they are appropriate, may marginally improve the success of market tools.

B. Severance Costs in Defining, Enforcing, and Trading Goods

A potential reason markets have not emerged in some environmental contexts or have not thrived in others is the high severance costs associated with creating or transacting in would-be environmental commodities. Such severance costs arise from attempts to define marketable environmental goods by isolating them from their complex physical, legal, or institutional settings.⁹⁴ This article stresses the importance of considering such costs, and it contributes to the literature by particularly emphasizing how the attempted “severance” or partitioning of environmental commodities contributes to such costs. To capture this insight, the Article uses the term “severance costs” to refer to the definition, enforcement, transaction, and other related costs that are particularly relevant to environmental goods (though the insight is also applicable to any goods that need to be de-contextualized to create tradable market commodities).

92. Of course, this does not mean that markets are static and that such conditions are unchangeable. Certainly, costs may change over time (e.g. transactions costs may change, technology may change, information may become available, or values may change), leading to the emergence of a new market.

93. If it ever does.

94. Cf. Dean Lueck & Thomas Miceli, *Property Law*, in 1 HANDBOOK OF LAW AND ECONOMICS 183, 208–209 (A. Mitchell Polinsky & Steven Shavell, eds., 2007) (discussing the costs of establishing an auction, rather than using first possession, for environmental market mechanisms such as pollution trading schemes or transferable fisheries quotas).

Efforts to define marketable environmental goods may involve unbundling them from their physical and social contexts (as with prior-appropriation water rights, discussed below) or constructing a commodity from relatively unstable regulations (as with nutrient-trading credits, also discussed below). The process can require complex coordination and can result in opaque assets. In aggregate, the effort and information necessary to define these commodities can involve high severance costs, which, in turn, can impede market formation by raising the costs of defining and enforcing property rights and of entering transactions.

Multi-party market formation outside of a specific contract requires standardization of the tradable commodity. The simpler and more discreet a “good” is, the easier it is to trade. We might describe such a good as having a relatively low severance cost. It is cheap to define, identify, and transact in a market. Conversely, the more a good is bound up in its context, the more complicated its contours, or the more information required to buy and sell it, the harder it is to trade. Such a good has a relatively high severance cost, and thus it becomes more difficult to transact in a market.

This concept is not novel. Though they have not used the term “severance costs,” both economic and legal scholars have recognized that the complexity of a good can increase the costs that impede its marketability.⁹⁵ As discussed above, the importance of definition, enforcement, and transaction costs are core insights from the work of Demsetz and Coase. Moreover, Buchanan also specifically noted the concept of severability as a foundational element of markets transactions, recognizing that individuals are only likely to initiate trades for “*partitionable* goods and services, those that are characterized by *full or quasi-full divisibility* among separate persons or small groups.”⁹⁶ Additionally, economists have empirically demonstrated how this theory of definition, enforcement, and transaction costs translates into practice. For example, Demsetz’s seminal observations were empirically based,⁹⁷ and more recent empirical economic literature also supports these observations. For instance, one study notes that land tracts defined by survey demarcation are more valuable than comparable tracts defined by metes and bound demarcations because the latter relies on more complicated, context-specific information, thereby raising information, enforcement, and transaction costs.⁹⁸

Legal scholarship has reached similar conclusions about how the complexity of assets-in-context can raise costs and interfere with market transactions. For instance, the core insight of Heller’s “anticommons” observation is that

95. See STEARNS ET AL., *supra* note 13 (discussing the costs associated with co-owned property); MERRILL & SMITH, *supra* note 38 (discussing “fancies”); see also Michael Heller, *Tragedy of the Anticommons: Property in the Transition of Marx to Markets*, 111 HARV. L. REV. 621 (1988). The complexity of an environmental good in context parallels an anti-commons because there are numerous dependent resources, if not owners.

96. BUCHANAN, *supra* note 82, at 36 (emphasis added).

97. See Demsetz, *supra* note 35.

98. See Gary D. Libecap & Dean Lueck, *Land Demarcation Systems*, in RESEARCH HANDBOOK ON THE ECONOMICS OF PROPERTY LAW 257 (Kenneth Ayotte & Henry E. Smith eds., 2011).

complicated webs of co-ownership and overlapping claims create barriers to transactions,⁹⁹ and this observation has been extended to the study of co-owned property. Merrill and Smith have made similar observations involving the “*numerus clausus*” and the standardization of property forms.¹⁰⁰ They observe that a menu of standardized property forms lowers information, enforcement, and transaction costs, leading to more transactions than would complex, customized, and contextual property interests (termed “*fancies*”).¹⁰¹ Merrill and Smith offer the example of how *fancies*, such as “Tuesday rights to a wristwatch,” impede alienation and trade of resources.

Nonetheless, despite the documented importance of definition, enforcement, and transaction costs to market formation and function, these concepts have not been sufficiently applied to analyses of environmental market tools. Environmental goods are not necessarily simple to sever. In fact, the very environmental features that one might hope to manage through a market mechanism are often complex and interconnected. Not only are such features parts of physically networked ecosystems (and thus potentially connected in links of food webs, hydrological interfaces, or other biotic interactions), but they are also subjects of potentially overlapping human institutions. For example, potential environmental goods may span public and private ownership; cross various state, federal, or national jurisdictions; and be subject to one or more complex legal and regulatory schemes. Protection of endangered species offers an example of such complexity. For instance, endangered jaguar populations in the southwest United States depend on access to a combination of surface water, woodlands, and rugged terrain, range across open spaces including public and private lands, and require habitat connectivity between multiple states as well as Mexico.¹⁰²

Accordingly, there are many attendant dependencies, influences, and claims that complicate a would-be marketable environmental good, making them subject to a vast web of interests. These interests may not necessarily be formal property rights (though they could be). Rather, they represent layers of expectations, investments, and reliance. As a result, would-be marketable environmental goods may be difficult to isolate, define, and partition. This also makes them difficult to standardize in some marketable form. Additionally, there is the complication of determining which “sticks” would be involved in the “bundle” of the newly created good, not to mention ensuring that new bundles do not conflict with preexisting ones. All told, to pluck an environmental good from that muddle and attempt to

99. See Heller, *supra* note 95.

100. See MERRILL & SMITH, *supra* note 38.

101. *Id.*

102. See, e.g., U.S. FISH AND WILDLIFE SERVICE, JAGUAR DRAFT RECOVERY PLAN (PANTHERA ONCA) ix–xi (2016), https://www.fws.gov/southwest/es/arizona/Documents/SpeciesDocs/Jaguar/Jaguar_Draft_Recovery_Plan_20_Dec_2016.pdf [https://perma.cc/Y7E2-3XX5]; CENTER FOR BIOLOGICAL DIVERSITY, JAGUAR, <https://www.biologicaldiversity.org/species/mammals/jaguar/index.html> [https://perma.cc/UKM9-9SQG] (last visited Feb. 5, 2019).

define it as a commodity, particularly when it is not necessarily associated with tangible, physical ownership or when it has not historically been commodified, involves severance costs. And, if these costs are too high, property interests may never be defined or transactions may never occur.

Having identified the concept of severance costs, the remainder of this Section considers instances where severance costs seem to explain why environmental markets have appeared to stall, such as in the context of prior-appropriation water rights and nutrient-credit trading schemes

Prior-appropriation water rights seem a poster-candidate for environmental market mechanisms, and thoughtful scholars have argued for such market tools to help reallocate water rights.¹⁰³ Such rights operate on a “first in time, first in right” basis, and many were established based on past incentives to capture water for then-valuable uses, such as agricultural irrigation. As a result, today relatively less-valuable agricultural users typically have superior rights to relatively more-valuable urban users. In such an instance, market transfers would make sense for reallocation when values change, as they have in many parts of the west, where urban water use is now more valuable (in market terms) than agricultural use. There seems a market opportunity here, and some trades do occur. However, water rights are not as widely marketed as one might expect,¹⁰⁴ and there are even legal provisions limiting such markets. Severance costs associated with the complexity of the water rights at issue seem to explain why.

Even though water rights appear to be partitioned into marketable units, the complexity of the water rights creates severance costs that interfere with such transfers. This is because the “water right” is defined in terms of water *diverted* from a stream, but not all of that diverted water is actually consumed and some returns to the stream as “return flow.”¹⁰⁵ Other downstream water users depend on this return flow for their own water rights, and these downstream users would be harmed if that return flow were removed. So, potential externalities (and laws designed to avert them) prevent the transfer of the legally-recognized *diverted* water right.¹⁰⁶ At the same time, it remains too costly to calculate and transfer only the *consumed* water quantity.¹⁰⁷ In this instance, the contextual complexity of the resource arises from physical aspects (the amount of water diverted versus the amount consumed, which can vary by particular conditions), social/legal ones (the reliance interests of downstream water users who would be harmed by the lack of return flow), and technological/informational ones (the cost of measuring water

103. See, e.g., Barton H. Thompson, *Markets for Nature*, 25 WM. & MARY ENVTL. LAW & POL’Y REV. 261 (2000).

104. For example, Lueck and Micelli offer the instance of western water regimes, which disallow transfers, as an example that seems at odds with neoclassical economic theories. See, e.g., Lueck & Micelli, *supra* note 94, at 245–249.

105. *Id.*

106. See, e.g., RASBAND ET AL., NATURAL RESOURCES: LAW & POLICY 5 (3d ed. 2016) (discussing the “no harm” rule).

107. *Id.*

consumed). All could change, but currently all contribute to the relatively high severance cost of trading western water rights as a commodity. These costs impede markets for water rights and underscore laws that dampen such markets. For example, under the “no harm rule,” many western water regimes disallow the transfer of an unsatisfactory unit (the diverted water right) if that transfer would cause an externality (harm to the downstream user),¹⁰⁸ and definitions costs prevent markets for units of water that would not impose externalities (i.e., consumed water). Thus, because of these severance costs, most transfers do not occur.

Similarly, the history of nutrient-credit trading demonstrates another instance of severance costs blocking robust markets. In seeking to preserve water quality, regulators have attempted to create market tools for dealing with water pollution via a cap-and-trade system.¹⁰⁹ Such a system imposes a total pollution cap on a water body and then allows polluters to trade pollution entitlements (“nutrient credits”) within that cap.¹¹⁰ However, in the past very few trades have resulted, even when explicitly encouraged or when prices have been such that trades would be expected.¹¹¹ Moreover, despite the lack of trades under past programs, decision makers are counting on new nutrient-credit trading programs to achieve major policy goals. For example, programs for the Chesapeake Bay anticipate trading to supply 40% of the Bay’s nutrient loading reduction,¹¹² and these programs are banking on the creation of new markets between relatively non-regulated agricultural operations (which can reduce nutrient runoff) and regulated entities (which would otherwise have to pay for more expensive means of pollution control).

Severance costs can explain the lack of trades under past nutrient-credit programs and can predict barriers to future trades under Chesapeake Bay programs. In the instance of nutrient credits, the physical complexity of calculating runoff reductions to define credits interacts with the regulatory complexity of pollution control laws to create high severance costs for nutrient credits. Additionally, severance costs here include establishing institutional credibility and trust, particularly when such trust is fundamental to establishing the commodity. For example, in the Chesapeake Bay, a relatively unregulated farmer may not wish to risk entering a trading program because she may fear that her involvement will lead to greater government oversight or regulation.¹¹³ The severance costs for this farmer include the risk of a change to the regulatory status quo, on which she relies if she joins the nutrient-trading market. Alternately, an environmental group that may wish to purchase nutrient credits in order to retire them may not trust the program to effectively calculate runoff reductions or receive adequate enforcement.

108. See, e.g., Lueck & Micelli, *supra* note 94, at 245–49.

109. Flatt, *supra* note 1, at 305.

110. *Id.*

111. *Id.* at 332–33.

112. *Id.* at 333.

113. *Id.* at 341.

In either case, the market for nutrient credits suffers (and possibly fails altogether) due to the costs of severance, which include the costs of building institutional trust and credibility of the program.¹¹⁴

These two examples help demonstrate how severance costs may manifest and impact the appropriateness, effectiveness, and design of environmental market tools. Along with the earlier discussion, they also help identify conditions likely to result in relatively high or low severance costs. Relatively low severance costs will likely accompany goods with easily appreciable contours and limits. This could be linked with physicality, which makes it simpler to ascertain the dimensions and delineation of a good. Similarly, low severance could also be associated with easily appreciable supply limitations, which often correspond with easily observed physical delineations. Finally, low severance costs may be associated with goods that are relatively standardize-able rather than bound up in context. Conversely, higher severance costs are likely to result from attempts at decoupling a good from an intertwined context, in instances where physical limits are not apparent, or where regulatory schemes are complex.

Applying these criteria, one can conceive of a spectrum of goods spanning from relatively low to relatively high severance costs. At the low end would be commodities (apples, wheat); land demarcated by survey; or well-provenanced fine art. Slightly higher costs come with land demarcated with metes and bounds or artwork of questionable provenance. Higher still might be relatively simple regulatorily-defined property, such as a carbon-emission allotments or fishery quotas. A higher severance cost would come from more complex goods like financial derivatives or prior-appropriation water rights. Finally, ecosystem services, like flood control, may come at extremely high severance costs.

This Section does not seek to rank all potential resources by severance cost or to list every source of severance costs. It merely uses these examples to illustrate the issue of severance costs as an important consideration for environmental markets. As Ostrom observed, one cannot solve environmental management problems simply by waving the wand of property rights or commanding markets to appear.¹¹⁵ Markets and rights may emerge, and severance costs help predict when. Attention to these costs helps identify when market mechanisms are likely to be effective and how they might be designed to maximize productivity.

C. Adjustment Failure Costs and the Risk of Applying Oversimplified Models to Complex Scenarios

In addition to severance costs, the adjustment failure costs inherent in the pricing system are another critical consideration for the appropriateness and design of environmental market tools. Most analyses of environmental markets rely on a

114. For a discussion of the importance of trust, see Elinor Ostrom, *Beyond Markets and States: Polycentric Governance of Complex Economic Systems*, 100 AMERICAN ECON. REV. 641, 642 (2010).

115. *See id.*

basic equilibrium model, which uses the simplifying assumption that supply and demand immediately align at some equilibrium point that results in efficient distribution of resources. This assumption is an intentional oversimplification, and in many instances it does not detract from the usefulness of the pricing model. In all markets, pricing results from an iterative trial-and-error process, and it takes time for supply and demand to align (assuming they ever do). Such delays and corrections result in some costs, which this Article terms “adjustment failure costs.” While adjustment failure costs may be trivial in many markets, they can be particularly high and material in the context of non-fungible or irreparable goods. Since environmental goods in particular may display such non-fungible or irreparable characteristics, consideration of adjustment failure costs is crucial because high adjustment failure costs can exceed the potential gains of the market system. This Section discusses the adjustment failure costs that arise in the iterative function of markets, positing that this is another key factor in determining the appropriateness and success of environmental market tools.

The simplified justification for markets as a method of environmental governance is that markets allow the pricing system to help resources flow to their highest valued uses.¹¹⁶ According to the equilibrium model, supply and demand align at an equilibrium point, resulting in a market-clearing price for a good. Like all models, this model of economic equilibrium is an intentional oversimplification of reality. For some purposes, this oversimplification is immaterial, but sometimes it can lead to unfounded assumptions about the speed and infallibility of market processes.

A well-worn economics joke¹¹⁷ illustrates the absurdity that can result from blind application of the simplified equilibrium model. The joke goes generally like this: An economics professor and a student are walking down the street. The student says, “Look, there’s a \$20 bill lying on the sidewalk.” The economics professor continues walking, without breaking stride or even looking down. She replies only, “You must be mistaken. If there were \$20 lying on the sidewalk, someone would have already picked it up.”

The durability of this joke appears to be in its dual function as both a concise illustration of economic principles as well as a cautionary tale about unyielding adherence to models. The economics professor delivers a succinct overview of core economic insights: typically, (1) incentives motivate individual behavior to capture value, (2) aggregated individual incentives lead to competition to capture value, and (3) competition leads to value being captured quickly. Thus, one does not commonly find \$20 bills lying on the sidewalk because: (1) individuals have incentive to capture \$20 bills when that involves merely picking them up off the

116. See generally RICHARD A. IPPOLITO, *ECONOMICS FOR LAWYERS* xv (2005) (describing the role of markets, trade, and profit in “directing resources to their most valuable uses”).

117. See Barry Popik, “If it were a real \$20 bill, someone would have picked it off the sidewalk already” (*economics joke*), *BIG APPLE* (Aug. 4, 2014), https://www.barrypopik.com/index.php/new_york_city/entry/if_it_were_a_real_20_bill [<https://perma.cc/PF34-2AD4>] (chronicling repetition of the joke).

ground, (2) nearly all individuals share this incentive, leading to competition for picking up \$20 bills from easily accessible sidewalks, and (3) the competitive environment for picking up money from public sidewalks means that any \$20 bills will be picked up quickly.

At the same time, the story is ironic because the economics professor undermines her very point. She does not act in line with her incentives, and her allegiance to theory leads her to ignore the reality before her (and thus, to forego \$20).

This story also conveys a lesson about the time it takes for markets to equilibrate. While there is a competitive market for picking up \$20 from the sidewalk, and one would expect that it would eventually equilibrate so that no \$20 bills remain on the sidewalk, this result does not happen instantaneously. Even competitive markets take time to adjust, and this is the reason that sometimes people *do* find money on sidewalks. The professor fails to acknowledge that markets do not produce immediate equilibrium results. By failing to pay attention to the time it takes for markets to work and by ignoring context-specific facts (Could the \$20 have been dropped only a short time ago? Is the street crowded? Might she be the first to walk by?), the economics professor becomes so blinded by the equilibrium model that it becomes a “straightjacket” that limits her thinking.¹¹⁸ She cannot see the value in front of her, and she acts against her own interest.

This joke is obviously a caricatured example, but it cautions against a recurrent risk of misapplying “mainstream” neoclassical economics and oversimplified models to generate simple policy prescriptions for complex realities.¹¹⁹ Further, as additional testament to the important lesson behind the joke, thoughtful economists continue to issue similar cautions against policy suggestions¹²⁰ (and some law-and-economics analyses)¹²¹ that mechanically apply similar models to nuanced problems.

This Section focuses on one important nuance not contained in the equilibrium model: the time it takes for markets to adjust. Economics literature makes clear that markets, even simple, functioning, and competitive ones, take time to approach equilibrium. In the case of most market goods, this is not a big issue. If widgets are underpriced or overpriced and take time to come to equilibrium, then there may be a temporary shortage or surplus, but the market eventually corrects and no lasting harm is done. However, in the environmental arena, the adjustment period in markets can cause irreparable harm to non-fungible resources.

118. See Boettke et al., *Riding in Cars with Boys: Elinor Ostrom's Adventures with the Police*, 9 J. INSTITUTIONAL ECON. 407, 422 (2013).

119. See Kirzner, *supra* note 23, at 62–65.

120. See *id.* (summarizing criticisms); ELINOR OSTROM, GOVERNING THE COMMONS: THE EVOLUTION OF INSTITUTIONS FOR COLLECTIVE ACTION, 214–215 (1990) (“The intellectual trap in relying entirely on models to provide the foundation for policy analysis is that scholars then presume that they are omniscient observers able to comprehend the essentials of how complex, dynamic systems work by creating stylized descriptions of some aspects of those systems.”).

121. See, e.g., Kirzner, *supra* note 23, at 80.

This Article applies these insights to draw attention to the importance of context-specific evaluation of the appropriateness and design of market mechanisms. As Ostrom observed, “When the world we are trying to explain and improve . . . is not well described by a simple model, we must continue to improve our frameworks and theories so as to be able to understand complexity”¹²² Appreciating adjustment failure costs seeks to do just that.

Once one pushes beyond simple models that assume markets result in immediate equilibria,¹²³ more nuanced analysis suggests that equilibrium is neither an immediate nor even necessarily a guaranteed result of market processes.¹²⁴ In fact, such analyses are quick to note that market pricing systems are essentially *processes* rather than equilibrium-based *results*. As one commentator has observed, “[i]f there is any equilibrium in the market system, it is limited to what we might call a *dynamic equilibrium* . . . the market order is not static . . . there exists no equilibrium but only a *process towards equilibrium* that is changing constantly.”¹²⁵

Moreover, the market process is one of trial-and-error. It is a repeated set of mistakes and corrections that celebrated economist Joseph Schumpeter famously described as a process of “creative destruction.”¹²⁶ In this process, markets set prices in response to “earlier entrepreneurial errors which have resulted in *shortages, surplus, [and] misallocated resources*.”¹²⁷ Markets then react to these errors, with some goods and entrepreneurs succeeding and others failing. This winnowing of market winners and losers is the essence of creative destruction, and it takes place through iterations of price adjustments.

To offer a stylized example that is consistent with most neoclassical models, imagine Firm A produces and sells widgets. Suddenly, the demand for widgets outstrips the supply, and a shortage of widgets results. Firm A raises the price of widgets, and demand drops as a result of the higher price (i.e., the market adjusts).

122. Ostrom, *supra* note 114, at 665.

123. See, e.g., JAMES R. BUCHANAN, *THE LIMITS OF LIBERTY: BETWEEN ANARCHY AND LEVIATHAN* (1975), reprinted in 7 *THE COLLECTED WORKS OF JAMES M. BUCHANAN* 46 (2000), available at <https://www.econlib.org/library/Buchanan/buchCv7c3.html#firstpage-bar> [<https://perma.cc/LKQ2-WANJ>] (“In this chapter I shall continue to work within what is essentially a timeless model; contracts are assumed to be *immediately* carried out, and by the same persons who enter the agreement.”) (emphasis added).

124. See, e.g., Kirzner, *supra* note 23, at 65 n.11 (summarizing the unrealistic premise behind the efficient markets hypothesis, and suggesting that it is unwarranted to assume that markets are always or already in equilibrium); see also BUTLER, *supra* note 21, at 52–53 (“The study of economics is the study of how adjustments are made in this constantly moving world; and to freeze the picture at one point in time, as the traditional textbook approach does, tells us precisely nothing The theory of competitive equilibrium therefore *assumes away* something which it is the main task of the process of market competition to discover.”) (emphasis in original).

125. BUTLER, *supra* note 21, at 57 (emphasis in original); see also Kirzner, *supra* note 23, at 60–61.

126. See Richard Alm & W. Michael Cox, *Creative Destruction*, *LIBR. ECON. AND LIBERTY*, <https://www.econlib.org/library/Enc/CreativeDestruction.html> [<https://perma.cc/NLY8-KMBP>] (last visited Feb. 5, 2019).

127. See also Kirzner, *supra* note 23, at 70 (emphasis added).

Given the high price of widgets and the potential for profit, Firms B and C join the market and supply increases (i.e., the market adjusts again). Now with Firms A, B, and C all producing a greater supply of widgets, the price of widgets falls (i.e., the market adjusts yet again). At the new low price of widgets, Firm A can no longer continue to viably produce them, so Firm A goes out of business and stops producing widgets (i.e., the market adjusts once again). The supply of widgets falls. Though the hypothetical could continue indefinitely, we can stop there.

This is certainly a stylized illustration, similar to one that might be found in a basic economics textbook. It reflects an equilibrium model and includes multiple market adjustments, the entry of two new firms, and the exit of one firm. On display are trial-and-error price corrections as well as entrepreneurial creative destruction. And, notably, though the supply of widgets increased and decreased, and though firms entered and exited, there was no long-term limitation on the number of widgets available or on the entry or exit of firms. It was all subject to the pricing system, ebbing and flowing with the trial-and-error process.

Most neoclassical economics relies on this model and suggests that this trial-and-error ultimately leads to an equilibrium state, but certain schools of economics doubt the certainty of such a result. They note that “this entrepreneurial process [of the market] *cannot guarantee* rapid (or slow) convergence to a state of equilibrium.”¹²⁸ In fact, some economists suggest that there is no reason to believe that there will ever be equilibrium; rather, they suspect that the trial-and-error process will just be a constant set of errors.¹²⁹ As a result, “instead of correcting the earlier misallocations of resources, the entering entrepreneurs may be making matters even worse. And such errors may generate still more errors.”¹³⁰

Even if one is more optimistic about the potential for reaching an equilibrium point, the trial-and-error pricing process still must play out. For example, within the field of experimental economics, controlled studies have shown that in simple, two-party markets, participants can often reach a predictable equilibrium, but even in such basic markets, it takes time and iteration to achieve any sort of equilibrium.¹³¹

128. *Id.* (emphasis added); *see also id.* at 72 (“The entrepreneurial market process may indeed reflect a systematically equilibrative *tendency*, but this by no means constitutes a *guaranteed* unidirectional, flawlessly converging trajectory.”) (emphasis in original).

129. *Id.* at 79 (“Lachmann (1986, 1991) saw the market process as one not only in ceaseless motion (on which the entrepreneurial discovery theorists would be in thorough agreement) but in a ceaseless motion in which at *no time is there any assurance that the equilibrative forces are stronger than the disequilibrative forces* (set in motion by changes in the independent variables of the system)—so that one may not presume to say that the market process even *tends* to promote mutual discovery among market participants”) (emphasis added).

130. *Id.* at 81.

131. *See, e.g.*, John A. List, *Testing Neoclassical Competitive Theory in Multilateral Decentralized Markets*, 112 J. POL. ECON. 1131, 1132–33 (2004); Charles R. Plott, *Equilibrium, Equilibration, Information and Multiple Markets: From Basic Science to Institutional Design* (2001), available at <https://www.haas.berkeley.edu/groups/finance/StfdBerk030409.PDF> [<http://web.archive.org/web/20171031190107/http://www.haas.berkeley.edu/groups/finance/StfdBerk030409.PDF>] (Paper

Thus, even if there is an eventual move toward equilibrium, it is necessary to account for “the speed and accuracy [or lack thereof] with which the system is able to identify and *overcome the waste and discoordination* of disequilibrium situations.”¹³²

All of this background regarding markets and price structures, iterative processes, and the time it takes to achieve equilibrium builds toward one crucial point. The process is not instantaneous, which means there are potential *costs* associated with markets and their trial-and-error cycles.¹³³ It is these adjustment failure costs that are a core concern of this Section, for they are nearly always overlooked but can have a major impact on the desirability of market approaches to managing environmental resources.

For ease of reference, this Article will term such costs “adjustment failure costs,”¹³⁴ and in the context of environmental goods, these adjustment failure costs may be substantial. As discussed above, the market process can result in “shortages, surplus, [or] misallocated resources,”¹³⁵ and the costs of misallocating environmental resources, and particularly underpricing them, can be high because such resources may be non-fungible and can suffer irreparable harm if overexploited due to too low a price. So, while normally the trial-and-error process of markets can simply readjust without lasting harm (as in the stylized example of widget production), in the case of environmental goods, the harms from errors can be lasting. The remainder of this Section discusses these adjustment failure costs in more detail and examines resources for which adjustment failure costs are likely to be particularly high.

Returning to the label of markets as engines of “creative destruction,” there is a fairly obvious concern with creative *destruction* when it comes to non-fungible or irreparable resources. Once they are destroyed, they may be destroyed for good, and the nature of non-fungible and irreparable resources means that we are not adept at recreating them. So, unlike widget production, which may fall and rise with prices, environmental goods that are exhausted during a low price point cannot necessarily be renewed. They are often naturally limited in terms of supply.

presented to the Nobel Symposium, Behavioral and Experimental Economics, Stockholm, December 4–6).

132. See also Kirzner, *supra* note 23, at 76 (emphasis added).

133. Cf. *id.* at 62. For Austrian economists, the “costs” of reaching equilibrium may be seen as an integral part of the information discovery function of markets. See, e.g., BUTLER, *supra* note 21, at 55–58. However, even regarded in this light, the information discovery comes with opportunity costs.

134. These could also be considered opportunity costs of the market process, particularly if a market-based management structure is contrasted with a different management regime, such as command and control. If opportunity costs describe the “next-highest-valued alternative use of that resource,” see David R. Henderson, *Opportunity Cost*, CONCISE ENCYCLOPEDIA OF ECON., <https://www.econlib.org/library/Enc/OpportunityCost.html> [<https://perma.cc/NV7H-5GN3>] (last visited Feb. 5, 2019), then the adjustment failure costs of the market could be seen as opportunity costs as compared to management under the other regime.

135. Kirzner, *supra* note 23, at 70; see also *id.* at 72 (“The entrepreneurial market process may indeed reflect a systematically equilibrative *tendency*, but this by no means constitutes a *guaranteed* unidirectional, flawlessly converging trajectory.”) (emphasis in original).

To make the same point in a slightly different way, market pricing systems can be seen as feedback mechanisms. Prices and supply inform each other in a feedback loop. However, with non-fungible resources or irreparable actions, the feedback loop can be severed. In such a case, a single low price signal, rather than spurring a continuously equilibrating response, can essentially end the cycle by depleting the resource beyond repair. This then cuts off the market process regarding the particular resource, relegating it to the destruction side of creative destruction. This greatly raises the stakes of the market's trial-and-error process because one particular error (for example, a low price period) no longer represents a point on the swing of a pendulum but rather can lead to exploitation that fixes a new upper limit on supply, permanently impacting the stock of an environmental good. This heavily concentrates risk because it essentially places a big bet on every possible price swing. The overall point is that adjustment failure costs not only exist as non-negligible considerations, but they also can be enormous in cases of non-fungible or irreparable resources.

The remainder of this Section addresses why environmental resources can demonstrate elements of non-fungibility and irreparability that makes them particularly likely to generate high adjustment failure costs. It also considers examples of specific resources likely to carry relatively high and low adjustment failure costs.

First, many environmental features are non-fungible because of the inherently unique characteristics of the goods themselves. There are no ready substitutes for them, and we cannot recreate them easily. Examples may include human health or the existence of a particular species. These cannot truly be substituted, standardized, or manufactured. Additionally, many environmental features either consist of or compose complex systems, and as noted *supra*, there are severe limitations on human abilities to design, steer, or create complex systems. For example, our civilization has not proven itself adept at creating wetlands, prairies, or a variety of other environmental goods, nor have we consistently created ready substitutes for the ecosystem services of these environments. This combination of uniqueness, complexity, and non-substitutability means that many environmental goods are non-fungible and irreplaceable.

Second, many actions exploiting environmental resources create irreparable impacts. This can arise from a combination of the non-fungibility of underlying environmental resources as well as the long-term consequences of certain uses of these resources. This combination contributes to a unidirectional pressure whereby the market process can systematically lead to relatively permanent decreases in resource stocks. Finally, the fact that many environmental resources are slow to demonstrate noticeable impacts means that crucial thresholds may be crossed before problems become apparent. Fisheries may crash very quickly when population drops below a sustainable replacement number. Thus, otherwise repairable impacts can become irreparable, and otherwise renewable resources can become depleted.

As a primary contributor to irreparability, the use of environmental goods can involve durable and path-dependent actions, frequently aimed at consumption or destruction of environmental features. For example, uses of environmental goods can involve development of wild lands, filling of wetlands, or cutting of timber. In some instances, these uses may simply exhaust some non-fungible resources. Short of that, resource uses can have long legacies.¹³⁶ Moreover, they can trigger a path dependence whereby the uses persist.¹³⁷ Additionally, privatization of resources¹³⁸ or even allowances for supposedly limited private access to public resources¹³⁹ can lock in certain uses that encumber those resources long into the future. This long-term commitment severely limits the ability to undo past resource commitments, thereby making exploitation irreparable or at least committing the resource to one use and foreclosing other options. Further, present markets may not adequately price the full costs of these long-term impacts because discount rates mean that their present value is greatly reduced.¹⁴⁰

Additionally, because some environmental uses are premised on the consumption or destruction of resources, the pricing system can create a unidirectional force toward diminished resource stocks, further exacerbating the irreparable impacts on non-fungible goods. Development of wetlands offers a concrete illustration. Developing wetlands typically involves functionally destroying a complex ecosystem, rendering an irreparable harm to a non-fungible good. If the price of developing wetlands is relatively high, then there will be less development, but this state of affairs is not locked in because future development is not foreclosed. If the price of developing drops, then the foregone development can proceed. However, if the price of development is relatively low, then there will be more development, and this state of affairs will essentially be locked in. Irreparable development of a non-fungible resource forecloses preservation of the resource, and foregone preservation cannot simply be renewed. The stock of wetlands is thereby permanently decreased.

This is an example of how, with non-fungible, irreparable goods, a low price event can lock in a market “error” represented by a single price point. Given the types of uses associated with environmental goods, there is the particular likelihood

136. See Eduardo M. Peñalver, *Land Virtues*, 94 CORNELL L. REV. 821, 853 (2009) (“The durability of land-use decisions’ consequences and the finite quantity of land mean that the decisions that current owners make about how to use their land will reverberate for generations.”).

137. See *id.* at 853, 855–56; cf. Libecap & Lueck, *supra* note 98 (noting it is costly to change from one demarcation system to another).

138. See Serkin, *supra* note 74, at 895–97, 903–04.

139. See Huber, *supra* note 66, at 995–96.

140. See, e.g., TYLER COWEN, *STUBBORN ATTACHMENTS: A VISION FOR A SOCIETY OF FREE, PROSPEROUS, AND RESPONSIBLE INDIVIDUALS* (2018) (arguing for a zero discount rate for environmental impacts).

that this will be a unidirectional phenomenon, leading to consumption or destruction that cannot be walked back.¹⁴¹

Thus, in terms of “creative destruction,” with non-fungible or irreparable resources, only the “destruction” half is operable. Since these resources cannot be created, then there is no meaningful likelihood of entry and no increase of supply in the market. That leaves only the destruction. Thus, each downward swing in price can threaten to permanently reduce the stock, which will not be replaced by upward price swings. Should prices swing down again, then once again there is a permanent reduction. Thus, the movement is that of one-way traffic. It is a ratchet toward diminution, locking in “errors” or “misallocations” that are part of the market process in a way that systematically leads toward environmental degradation.

Finally, environmental goods may be particularly subject to irreparable impacts because their complexity may make them difficult to monitor, slow to reveal damage, or subject to scientific uncertainty. This can mean that impacts that would otherwise be repairable can be extended beyond crucial thresholds and become irreparable. In this way, otherwise renewable resources may be permanently reduced or even destroyed. Hunting or fishing species to near extinction (like Bluefin tuna),¹⁴² degradation of arable land,¹⁴³ or unsustainable extraction from rechargeable aquifers¹⁴⁴ are examples (you can literally “[not] miss your water til your well runs dry”).¹⁴⁵ Even if this does not lead to truly irreparable impacts, this slow feedback signal can increase adjustment failure costs.

Of course, different resources will fall along a spectrum of relative fungibility and irreparability, and thus will have different relative adjustment failure costs. Relatively high adjustment failure costs seem likely in the case of ecosystems (wetlands and prairies, for example), specific species (endangered species), and threshold scenarios like carbon emission totals for climate change tipping points. On the other hand, adjustment failure costs are relatively low for renewable resources that have not crossed critical thresholds (like fishery stocks or some aquifers). This can also be true of certain habitats that may renew if not completely and continuously prevented from doing so (e.g., the Rocky Mountain Arsenal).¹⁴⁶

141. In theory, there could be legal constraints, such as conservation easements or designations of national parks, that go the other direction and make it difficult to undo past conservation decisions.

142. See Fiona Harvey, *Overfishing Causes Pacific Bluefin Tuna Numbers to Drop 96%*, GUARDIAN (Jan. 9, 2013, 12:17 AM), <https://www.theguardian.com/environment/2013/jan/09/overfishing-pacific-bluefin-tuna> [<https://perma.cc/P4NH-SDCK>].

143. See Oliver Milman, *Earth Has Lost a Third of Arable Land in Past 40 Years, Scientists Say*, GUARDIAN (Dec. 2, 2015, 5:00 AM), <https://www.theguardian.com/environment/2015/dec/02/arable-land-soil-food-security-shortage> [<https://perma.cc/9GQF-85GS>].

144. See *Groundwater Depletion*, U.S. GEOLOGICAL SURV., <https://water.usgs.gov/edu/gwdepletion.html> [<https://perma.cc/SH3Y-AJPL>] (last modified Dec. 9, 2016).

145. See WILLIAM BELL, *YOU DON'T MISS YOUR WATER* (Stax Recording 1961) (covered by Otis Redding, *Otis Blue* 1965; Taj Mahal, *The Natch'l Blues*, 1968; and The Byrds, *Sweetheart of the Rodeo*, 1968, among others).

146. See RASBAND ET AL., *supra* note 106, at 5 (discussing the Rocky Mountain Arsenal, which currently hosts a diverse ecosystem that has grown up over heavily contaminated military site).

In sum, this Part has highlighted the importance of adjustment failure costs. In certain instances, particularly with non-fungible goods or irreparable harms, the adjustment failure costs of the market process may be so great that they outweigh whatever potential gains may result from the market pricing system. Adjustment failure costs are likely to be high with non-fungible or irreparable goods, and environmental goods can show a likelihood of being non-fungible and irreparable. Thus, adjustment failure costs must be a major consideration for the appropriateness and success of environmental market mechanisms.

III. THE SEVERANCE COST/ADJUSTMENT FAILURE COST MODEL AND ITS APPLICATION TO ENVIRONMENTAL GOVERNANCE AND OTHER MARKET MECHANISMS

These insights about severance costs and adjustment failure costs can be applied for evaluating efforts to use markets for environmental governance. In particular, they can be used to gauge the appropriateness and design of attempts to introduce markets into contexts, such as certain environmental governance scenarios, where markets have not emerged and there is no history of commodification.

This Part builds a model for evaluating the appropriateness and design of market mechanisms for such resources. It does so by considering how severance costs and adjustment failure costs interact to impact markets, as well as by analyzing how the severance costs and adjustment failure costs attendant to particular resources impact their suitability for market governance. To aid in this analysis, Section A offers a graphical representation of the model as a scatterplot. Using this graphic, it charts how severance costs and adjustment failure costs can explain the emergence of markets as well as the non-commodification of certain resources. It also identifies instances where market-based regulatory tools are potentially applicable and can be designed for the greatest likelihood of success. Finally, it considers how particular market-based tools might fit with particular resource governance challenges given their mix of severance and adjustment failure costs. Section B then explores implications of this model for resources outside of the environmental context.

A. How Severance and Adjustment Failure Costs Interact and Inform the Choice of Environmental Governance Institutions

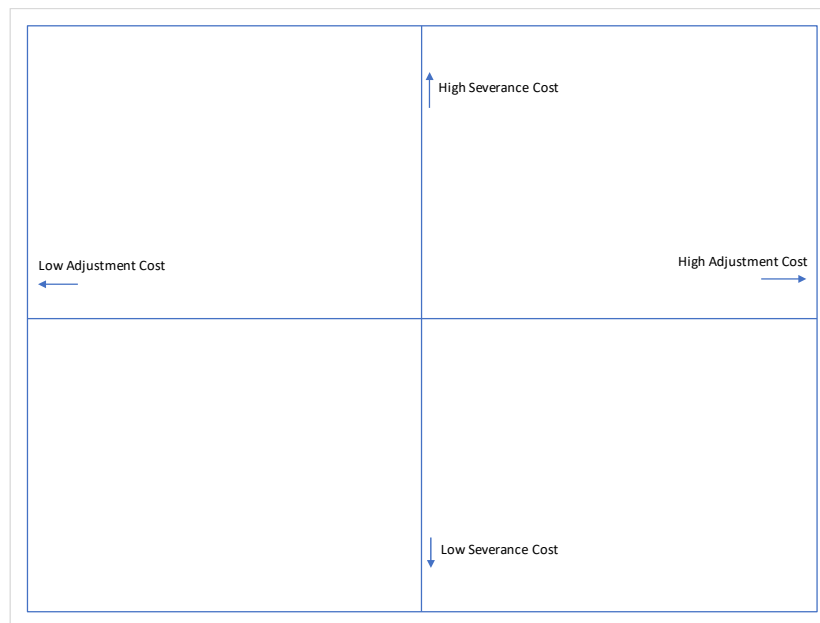
As the previous Part discussed, severance costs and adjustment failure costs are both important dimensions that influence development of markets. When considered together, these costs create a descriptive model of market emergence and success. If these costs are too high, either individually or in combination, they will exceed the potential gains of a market system and markets are unlikely to form or succeed. On the other hand, if these costs are sufficiently low, then markets will emerge naturally and are likely to sustain. Finally, at marginal levels of these costs,

there is the possibility that markets may be introduced and that specific aspects of market design can marginally impact their chances of success.

To illustrate these dynamics and make the model more concrete, this Section introduces a graphical depiction of the interface between severance costs and adjustment failure costs. It starts by introducing a basic Severance Cost/Adjustment Failure Cost plot that establishes quadrants for analysis, and it builds to more complex depictions and applications from there. It then uses this graphical framework to analyze specific resources and the market tools that might be most appropriate for them.

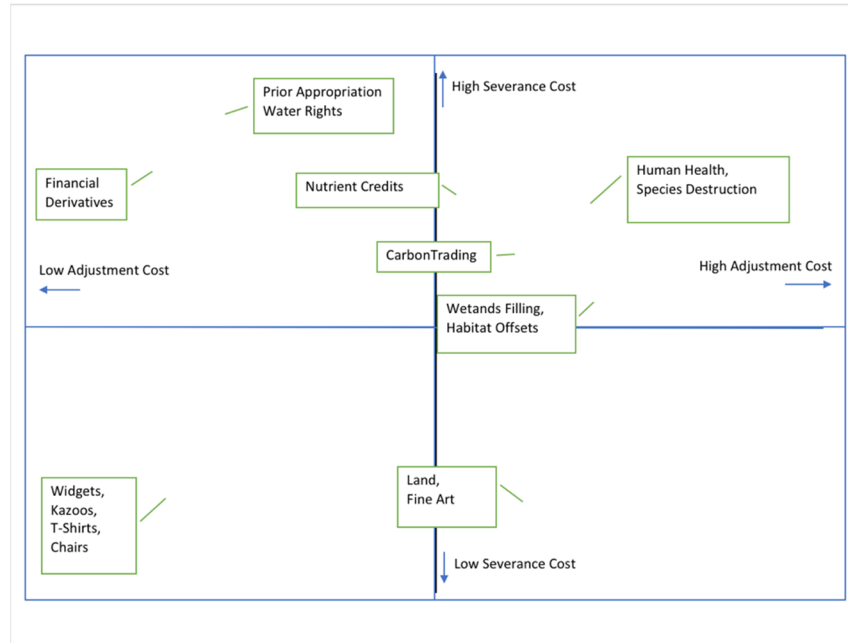
To begin, Figure 1 (below) establishes a basic Severance Cost/Adjustment Failure Cost plot.

Figure 1: Severance Cost/Adjustment Failure Cost Plot



This is a scatterplot, not just quadrants, because these cost values are not binary. Rather they fall relatively along a spectrum, and if costs change for certain resources, then those resources can change their relative positions within the plot.

For context, we can populate this plot with some of the resources discussed above. Figure 2 shows the matrix with some example goods.

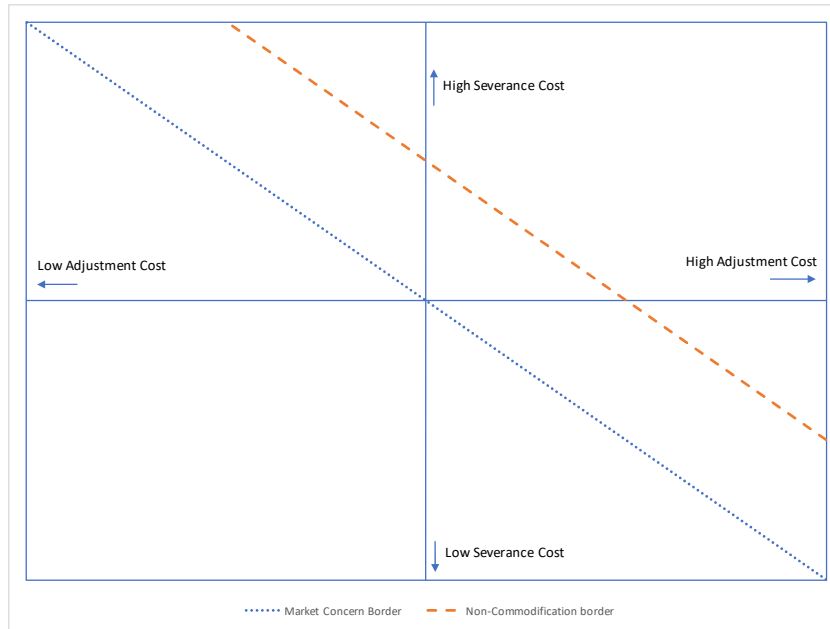
Figure 2: Severance Cost/Adjustment Failure Cost Plot with Example Goods

This depiction helps locate the relative costs of goods discussed in the previous Part.

In addition to delineating these goods relative to each other, the plot also offers insight into the impacts of severance cost and adjustment failure cost on commodification. As discussed, high severance and adjustment failure costs, either individually or in combination, can impede market emergence and success. At levels where severance costs and adjustment failure costs start raising concerns about the appropriateness of markets, we might identify a “market concern border.” Moreover, as these severance and adjustment failure costs rise even higher, individually or combined, they reach a point where the costs of the market are not worth the potential market gains. At such levels, we might identify a “non-commodification border,” beyond which markets are not appropriate.

Figure 3 depicts these boundaries on the plot, designating the market-concern border and the non-commodification border. As a note, these borders should be represented by curves instead of lines, but they appear linear for simplicity of the graphic.

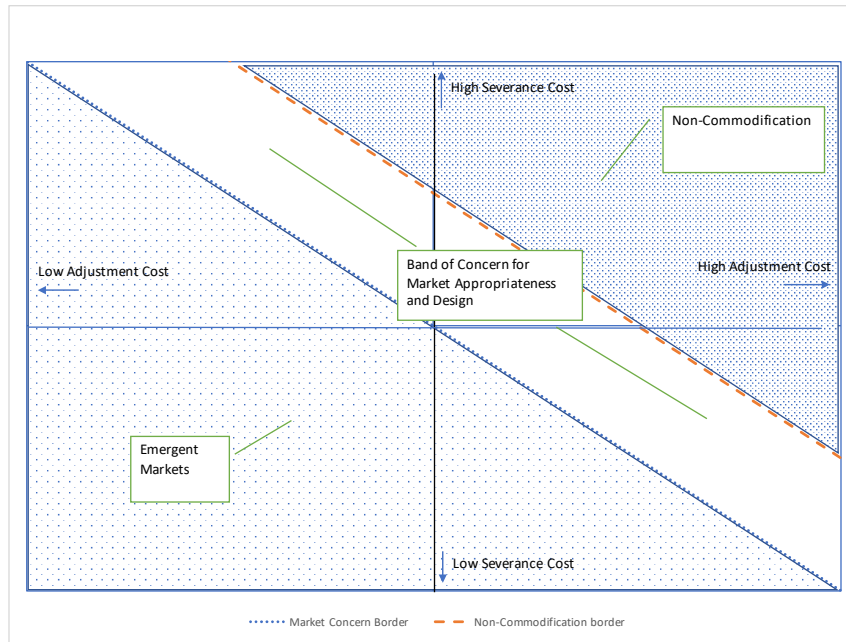
Figure 3: Severance Cost/Adjustment Failure Cost Plot with Market Concern Border and Non-Commodification Border.



The area between the market-concern border and the non-commodification border represents a marginal band in which relatively small changes can impact the tipping point of whether market benefits outweigh market costs. We might label this area the “marginal band of concern for market appropriateness and design” (“marginal band”) because within such areas specific market design elements impact the viability and durability of markets. This marginal band is an area of focus for the introduction of market-mechanisms, particularly market-based regulatory tools for environmental governance. The area below the marginal band (i.e. to the lower-left of the market concern border) represents emergent markets, where costs are sufficiently low that markets have arisen and sustained themselves. Within such emergent markets, appropriateness and design are less of a concern. The area above the marginal band (i.e. to the upper-right of the non-commodification border) represents instances where markets have not emerged and commodification seems inappropriate.

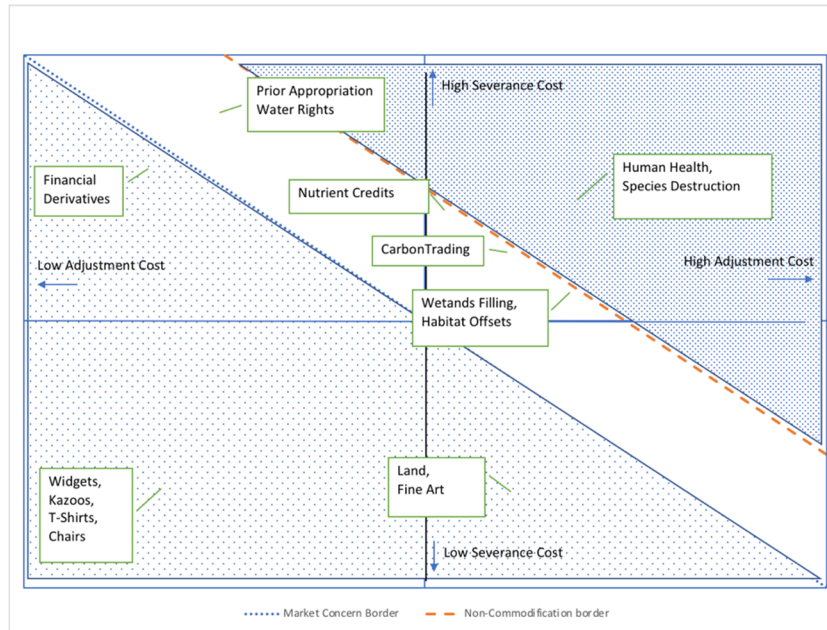
Figure 4 illustrates these respective areas.

Figure 4: Severance Cost/Adjustment Failure Cost Plot with Areas of Emergent Markets, Appropriateness and Design Concern, and Non-Commodification



To make these theoretical areas concrete and applicable to resource management concerns, once again, we can populate this plot with the same resources discussed above. Doing so demonstrates how the different resources discussed fall within these areas. Figure 5 illustrates this.

Figure 5: Severance Cost/Adjustment Failure Cost Plot with Areas of Emergent Markets, Appropriateness and Design Concern, and Non-Commodification as Well as Superimposed Resources.



Populating the model with such resources demonstrates its descriptive power and offers insights into market emergence and success. For example, Figure 5 (directly above) helps answer the question posed in the Introduction about why a market for carbon may be acceptable whereas one for human health is not. For human health, the combined severance costs and adjustment failure costs are so high that it falls into the non-commodification area where markets are not justified. Carbon, on the other hand, falls within the marginal band, where severance costs and adjustment failure costs are not low enough that robust markets have emerged but are sufficiently marginal that an introduced market may be appropriate (and that attention should be paid to the design of such a market instrument).

Importantly, as noted earlier, the locations of resources on this plot are not necessarily static. The position of resources can change as severance costs and adjustment failure costs change. For example, if severance costs decrease (such as through a reduction in transaction costs or information costs in defining property rights), then a resource formerly in the non-commodification area may fall into the marginal band or even into the area of emergent markets. Commentators have posited that the advent of barbed wire worked just such a change by lowering the severance costs for land on the ranges of the west, allowing for cheaper delineation

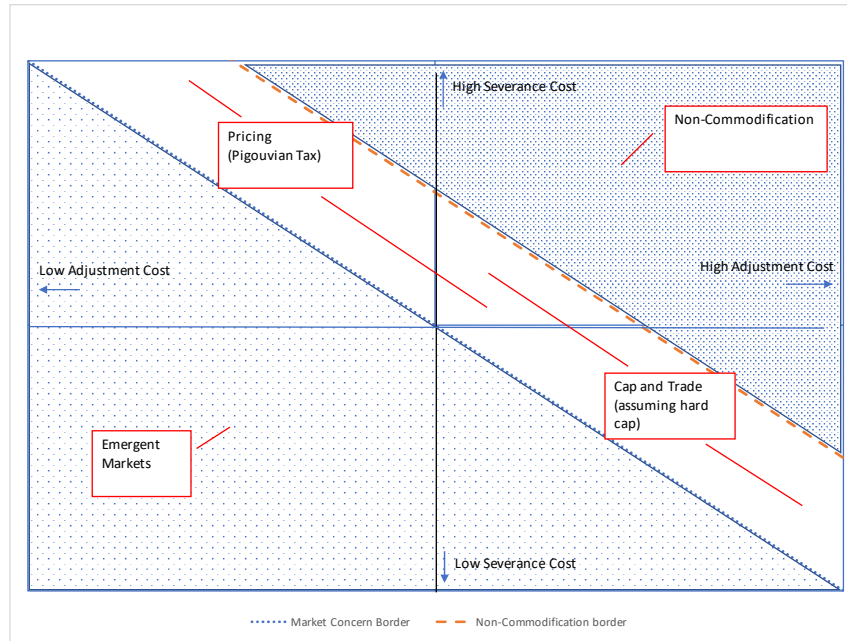
of property rights and increased market transactions.¹⁴⁷ This observation is consistent with the model, and new technologies may come about to lower severance costs for resources like carbon emissions or prior appropriation water rights, leading to emergent markets (or more easily implemented market-based regulatory tools) for those resources. Such could be true of any resource, though some are more likely than others. For example, current prospects for technology are unlikely to substantially decrease the severance costs of highly complex systems like ecosystems (such as wetlands or habitat). Nonetheless, one may hope.

It is also important to note the limitations of the plot above. Though it offers a convenient and concrete illustration of the descriptive power of the model, the plot is only as good as the data used to populate it. As pictured, it is based on underlying cost assumptions that, if inaccurate, obviously change the points on the plot. So, if assumptions about irreparability of nutrient pollution, for example, are incorrect, then the plotting of nutrient credits and subsequent analyses will also be incorrect. Second, if these costs change, which they easily may, then the location of goods on the plot also changes. Thus, however useful the model may be, the challenge to wielding the model is in locating a resource on the plot. That said, assuming that information is correct (or corrected in light of changes) the model reveals important descriptive insights.

In addition to the descriptive power of the model, it can also be used prescriptively to analyze the market-based regulatory tools that may work best with certain cost scenarios. For example, the model can be used to recommend where, within the marginal band, a cap-and-trade approach may be preferable to a pricing system, and vice versa. Again, the plot is helpful for this analysis because it can chart market interventions that may best apply to the resources that occupy certain cost positions. Figure 6 does so.

147. JESSE DUKEMINIER ET AL., PROPERTY 33 (9th ed. 2018).

Figure 6: Severance Cost/Adjustment Failure Cost Plot with Market Design Interventions



This depiction helps visualize which market mechanisms may best match certain mixes of severance costs and adjustment failure costs.

For example, a laissez-faire approach is appropriate primarily (possibly only) in the emergent markets area (the area to the lower-left of the market concern border). This is because absent sufficiently low severance costs, property rights will not be easily defined, and without regulatory intervention to define property rights and establish markets, trades may not occur. This absence of clear property rights and trades would disable the market functions central to a laissez-faire system. Moreover, a laissez-faire approach would entail resigning from any normative environmental baseline and putting faith in the market process, regardless of what outcome it may produce.¹⁴⁸ This seems advisable only in instances where adjustment failure costs are low, because if adjustment failure costs are high, then market swings are likely to lead to unidirectional irreparable results.

For these same reasons, in instances where severance costs and adjustment failure costs are high enough to be within the marginal band, laissez faire approaches

148. See *supra* Part I.A. The same criticism may be made of adaptive management approaches that are untethered to normative baselines. Cf. Pidot, *supra* note 25, at 164 (“If the goals of governance are up for grabs in an adaptive management process, this renders the project of governance inherently unstable.”); Holly Doremus, *Adaptive Management As an Information Problem*, 89 N.C. L. REV. 1455, 1469 (2010) (identifying “the need for clear goals set exogenously to the adaptive management process”).

are unlikely to be appropriate. Instead, market-based regulatory tools appear more appropriate within the marginal band, and particular mixes of severance costs and adjustment failure costs suggest particular deployments of either cap-and-trade or pricing systems.

Cap-and-trade approaches appear most appropriate in instances within the marginal band where severance costs are relatively low, but adjustment failure costs are relatively high (this is the lower-right portion of the marginal band). Assuming that a hard cap can be set and enforced, then a cap-and-trade system can effectively protect high adjustment failure cost goods from destruction and irreparable harm because the cap sets a normative baseline of exploitation. The nature of the cap ensures that resource supplies never dip below a certain level, and with the cap ensuring that level of supply, then prices can move with changes in demand. Thus, trades can occur under the cap, and market processes can allocate resources, with the cap serving as a backstop against resource depletion.

However, setting and enforcing a hard cap likely requires relatively low severance costs, because low severance costs, which make it easier to define and enforce rights in the units of a good, consequently also make it easier to define and enforce a cap (which is just an aggregation of units of a good). Additionally, low severance costs make it easier to define takings-protected property rights, which would also give private incentives for monitoring and enforcement of the cap as well as political insulation against loosening the cap.¹⁴⁹

In fact, in instances where severance costs are relatively high, and thus rights to goods are not sufficiently defined or enforced, cap-and-trade programs have not fared well. For example, offset programs (whereby preservation or mitigation efforts are used to counterbalance development) frequently come in for criticism because the offsets are not satisfactorily calculated or policed, leaving no assurance that they are effective.¹⁵⁰ This was a frequent criticism of the REDD program, in which credits for mitigating tropical deforestation are used in carbon offset programs.¹⁵¹ Initially, commentators suggested that the REDD program was ineffective because the credits were not sufficiently verified or enforced,¹⁵² and these verification and enforcement problems can be considered a severance cost of the REDD credits. REDD also illustrates how changes can move a point on the

149. See *supra* Part I.C.2.

150. See, e.g., David Takacs, *Are Koalas Fungible? Biodiversity Offsetting and the Law*, 26 N.Y.U. ENVTL. L.J. 161, 167–95 (2018) (describing biodiversity offsetting programs and the controversies surrounding them).

151. See CAL. AIR RESOURCES BOARD, INTERNATIONAL SECTOR-BASED OFFSET CREDITS, <https://www.arb.ca.gov/cc/capandtrade/sectorbasedoffsets/sectorbasedoffsets.htm> [<https://perma.cc/YVA5-FXG2>] (last reviewed Mar. 16, 2016).

152. See, e.g., Annecoos Wiersema, *Climate Change, Forests, and International Law: REDD's Descent into Irrelevance*, 47 VAND. J. TRANSNAT'L L. 1, 58–61 (2014).

scatterplot. Subsequent changes to the program have sought to successfully address and lower some of these severance costs.¹⁵³

Similarly, though the Clean Water Act's section 404(b) wetlands program imposes a cap of "no net loss of wetlands," this cap is effectively illusory because of severance costs.¹⁵⁴ As discussed above, there has been significant loss of wetlands under this current regime because loosening definitions of wetlands and generous mitigation allowances have eroded the cap.

Alternatively, pricing systems seem most appropriate in conditions that are inverse to those which would recommend a cap-and-trade approach. While cap-and-trade approaches should thrive in situations where severance costs are relatively low, but adjustment failure costs are relatively high, pricing systems appear suited to contexts within the marginal band where severance costs are relatively high, but adjustment failure costs are relatively low (this is the upper-left portion of the marginal band).

Pricing systems do not necessarily rely on the creation of property rights; they merely assess a tax on certain activities. Thus, instances of relatively high severance costs in defining property rights do not serve as a particular impediment to pricing systems, which can impose costs on behaviors without unbundling particular resources from their complex contexts. Thus, pricing systems prompt resource users to internalize some of the cost of the resource use, but such pricing does not have to overcome the full severance cost associated with defining and commodifying a resource.

However, effective pricing systems likely require low adjustment failure cost scenarios. As discussed above, price setting is a difficult endeavor and is unlikely to assure a particular level of resource use. Contexts of high adjustment failure costs would mean that errors in price setting result in irreparable harms to non-fungible resources, but low adjustment cost resources will not be permanently injured by errant price setting.

Finally, for resources in the non-commodification area of the plot (to the upper-right of the non-commodification border) market mechanisms appear inappropriate due to the combination of high severance costs and high adjustment failure costs. For resources in this non-commodification area, command-and-control governance may be the only acceptable option. As discussed above, cap-and-trade systems are unlikely to usefully protect such resources because their high

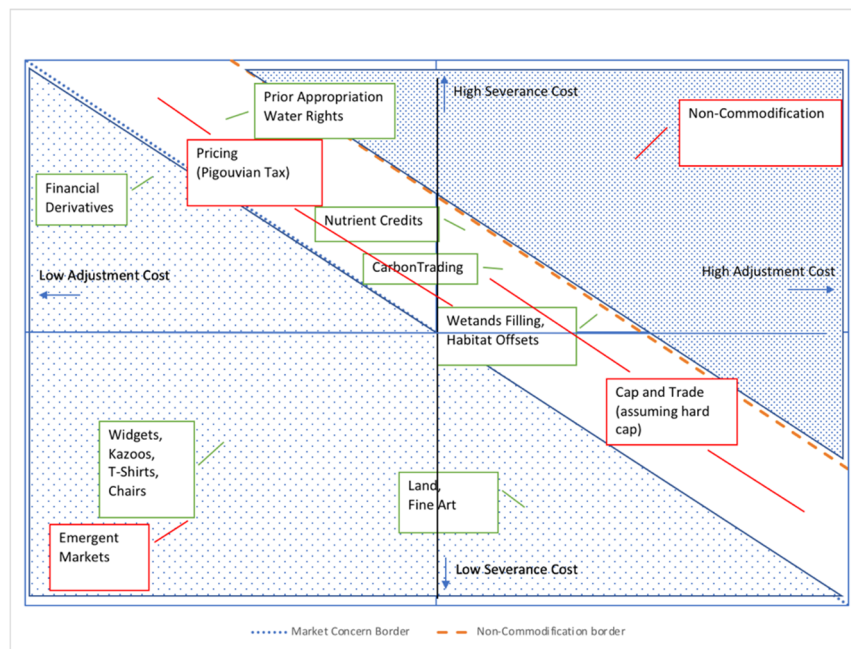
153. See Renee Cho, *Making Progress on Deforestation*, EARTH INST., COLUM. U.: STATE OF THE PLANET (June 23, 2014), <https://blogs.ei.columbia.edu/2014/06/23/making-progress-on-deforestation/> [<https://perma.cc/XQT7-T9VZ>] (noting how better monitoring efforts improved the efficacy of REDD+ programs).

154. See, e.g., U.S. ENVIRONMENTAL PROTECTION AGENCY OFFICE OF INSPECTOR GENERAL, EPA NEEDS TO CLARIFY ITS CLAIM OF "NO NET LOSS" OF WETLANDS (2014), <https://www.epa.gov/sites/production/files/2015-09/documents/20140416-14-p-0191.pdf> [<https://perma.cc/LFN4-YJY2>] ("The EPA needs to clarify that its claim of 'no net loss' of wetlands is based on projections of future results from mitigation projects, because not all mitigation projects succeed.").

severance costs make maintenance of a hard cap unlikely. Additionally, the high adjustment failure costs of these resources mean that pricing systems will likely lead to irreparable harms. Moreover, a laissez-faire approach for such resources would likely be ineffective because markets would be unlikely to emerge due to high severance costs, and resource levels would erode due to high adjustment failure costs.

With these insights, we may turn once again to the graph and add specific resources to the plot of interventions. This allows a depiction of market approaches mapped onto relevant resources. At the risk of too crowded a final figure, Figure 7 presents a plot of market approaches overlaid with resources.

Figure 7: Severance Cost/Adjustment Failure Cost Plot with Design Interventions and Resources



This final figure offers a sense of how the plot can be used prescriptively to recommend particular environmental governance regimes for particular resources.¹⁵⁵

Market mechanisms are potentially potent tools for addressing environmental governance challenges, and this Section treats market-based tools as just that: tools.

155. This may help explain the ongoing debate between a carbon tax or a carbon cap-and-trade system, because carbon credits reflects both high adjustment failure cost and relatively high severance costs, though, in the opinion of this article, the adjustment failure cost outweighs and advises toward a cap.

Thus, it engages environmental market tools on a practical, pragmatic level, viewing them as a potential means to an end and seeking to improve the likelihood that, if such tools are deployed, they are deployed successfully. As a result, it considers the appropriateness and design of market tools based on their likely effectiveness, relative to other options, in the particular contexts where they might be applied.¹⁵⁶ The model discussed above provides insight for such an analysis.

B. Applicability to Market Appropriateness Beyond the Environmental Context

Variations of the severance cost/adjustment failure cost model can also inform other policy areas faced with questions of whether governance of certain resources should be left to market forces. For example, the model holds descriptive and prescriptive potential in the context of evaluating markets for human materials and organs as well as in the contexts of licensure requirements for certain professions and platforms. In these instances, the policy options typically involve a more binary choice between market or regulatory governance, so the model can be simplified to consider only those choices and omit consideration of market-based regulatory approaches such as cap-and-trade.

The treatment of human materials and organs has received a great deal of attention from the perspectives of health policy, property theory, and economics,¹⁵⁷ and the severance cost/adjustment failure cost model can help advance each. In all of these disciplines, an ongoing subject of interest has been whether and when human tissue should be treated as a marketable commodity. Current laws permit the sale of some human materials, like blood or semen, while prohibiting the sale of others, like kidneys.¹⁵⁸ As a descriptive matter, this disparate treatment can be explained by the model. For materials like blood and semen, severance costs are relatively low; they can be separated from the seller with relatively little pain. Adjustment failure costs are also low. These materials are renewable, so their alienation causes no irreparable harm on the seller. These low costs can explain why markets have emerged for these materials and why laws have not disallowed such markets to continue.

On the other hand, human organs like kidneys have relatively high severance costs and adjustment failure costs. To separate a kidney from a would-be seller involves an invasive surgical procedure, and since every person has only two kidneys, the removal of one has irreparable consequences. As the model would

156. A key insight of Ostrom's work is that context and details are important to addressing environmental issues. *Cf.* Ostrom, *supra* note 78, at 642 (“[T]he application of empirical studies to the policy world leads one to stress the importance of fitting institutional rules to a specific social-ecological setting. ‘One size fits all’ policies are not effective.”).

157. *See, e.g.*, Lee Anne Fennell, *Adjusting Alienability*, 122 HARV. L. REV. 1403, 1465 n.7 (2009) (noting “[h]undreds of articles and books have addressed the sale of human tissue”).

158. *See, e.g.*, *Flynn v. Holder*, 684 F.3d 852 (9th Cir. 2012).

predict, given the high severance and adjustment failure costs involved, laws prohibit market transactions for kidneys.¹⁵⁹

Laws governing surrogacy reflect this as well. Many states treat gestational surrogacy contracts differently from contracts with a surrogate who also has a genetic connection with the child.¹⁶⁰ Enforcing surrogacy contracts against women who are not also genetic mothers reduces adjustment failure cost (lesser problem of regrets and contract renegeing) as well as severance costs (legal rights clearly defined) for the various parties involved.

Finally, the model can also explain changes in the law surrounding human materials. For example, extraction of bone marrow cells formerly involved a painful, invasive procedure, and when that was the prevailing process, sale of bone marrow was legally prohibited.¹⁶¹ However, when a new procedure emerged such that the process for extracting bone marrow cells became no more painful or invasive than drawing blood, courts ruled bone marrow extracted by this new process could be legally sold.¹⁶² Consistent with the model, when a technological advancement substantially lowered the severance cost associated with bone marrow extraction, the legal regime changed from prohibiting to allowing markets for bone marrow.

Thus, the model has potential to usefully describe the treatment of human materials, and when questions arise, it can suggest future policy directions for such resources by counseling when markets may be appropriate due to low severance and adjustment failure costs.

Additionally, another variation of the model can be applied to evaluate licensure regimes that restrict access to certain professions. Many professions, ranging from doctors to barbers, plumbers to florists, and electricians to coffin-makers, are subject to licensure requirements. Advocates for licensure suggest that such measures are necessary to protect consumers, whereas opponents of licensure argue that competitive market forces should be sufficient to sort reputable professionals from potentially harmful ones.¹⁶³

In evaluating the advisability of licensure requirements for certain professions, policymakers might apply the severance cost/adjustment failure cost model. In the case of licenses, severance costs are relatively low across most professions; licenses are fairly able to define the relevant scope of work for different professions, and enforcement costs likely will not vary too much between professions. However, adjustment failure costs can vary greatly between professions subject to potential

159. The exception being in Iran, where there is a legal market for kidneys. See MERRILL & SMITH, *supra* note 38, at 231.

160. Mark Strasser, *The Updating of Baby M: A Confused Jurisprudence Becomes More Confusing*, 78 U. PITT. L. REV. 181, 192–93 (2016).

161. See, e.g., *Flynn*, 684 F.3d.

162. *Id.* at 864–65.

163. See S. David Young, *Occupational Licensing*, LIBR. ECON. AND LIBERTY, <https://www.econlib.org/library/Enc1/OccupationalLicensing.html> [https://perma.cc/6SGD-NCPM] (last visited Feb. 5, 2019).

licensure. Adjustment failure costs for barbers and florists are relatively low; hair typically grows back, and bouquets, however beautiful or awful, are impermanent. This combination of low severance and adjustment failure costs suggests that a laissez-faire approach, rather than licensure, may be appropriate for professions like bakers and florists. On the other hand, adjustment failure costs for doctors and electricians can be relatively high because medical malpractice and electrical fires can affect irreparable damage to non-fungible resources, such as human health. As a result, licensure may be more appropriate and important for professions that exhibit such higher adjustment failure costs because the cost of market corrections in these areas (i.e., patients dying or houses burning down) may be unacceptably high.

In a similar way, the model can also inform policy debates over the appropriate level of licensure or regulation for “gig economy” platforms like Airbnb or Uber. Such platforms typically include ratings systems, and those arguing for laissez-faire treatment of these platforms contend that these ratings will impose market accountability that can protect consumers better than regulation might. However, proponents of regulation view these ratings as insufficiently protective of customers. An analysis of adjustment failure costs can contribute to this debate, suggesting that if adjustment failure costs are sufficiently high (for example, if there are sufficient threats to human health by assaultive Airbnb hosts or Uber drivers), then the ratings system may not be sufficiently protective because it relies on market adjustment for protection. However, if adjustment failure costs are relatively low, then a ratings system may be all that is necessary.

IV. AN ECONOMIC FRAMEWORK FOR NON-COMMODIFICATION THEORIES

In addition to its practical utility, the severance cost/adjustment failure cost model also contributes to theoretical and academic debates about commodification. Indeed, it can supply a unifying economic framework to support a number of commodification theories, including arguments that are often framed in moral terms. By providing not only a synthesizing function but also an economic explanation for moral positions, the model can perform a translational and facilitative service for commodification debaters that might otherwise risk talking past each other.¹⁶⁴

In service of this goal, this Part first offers a brief survey of major theories and scholarship addressing non-commodification and inalienability of resources. It then applies the model to explain how severance costs and adjustment failure costs offer an encompassing framework for these theories.

The survey begins with Guido Calabresi and Douglas Melamed’s seminal article *Property Rules, Liability Rules, and Inalienability*.¹⁶⁵ In that piece, Calabresi

164. See RASBAND, ET AL., *supra* note 106, at 2–10.

165. Guido Calabresi & A. Douglas Melamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral*, 85 HARV. L. REV. 1089, 111–15, 1123–24 (1972).

and Melamed offer a variety of rationales to justify non-commodification and inalienability of resources. For example, they suggest that inalienability might reduce externalities in some contexts, such as when a transferee might use a resource to harm others.¹⁶⁶ They also offer “moralisms” as a justification to support non-commodification, positing that

[i]f Taney is allowed to sell himself into slavery, or to take undue risks of becoming penniless, or to sell a kidney, Marshall may be harmed, simply because Marshall is a sensitive man who is made unhappy by seeing slaves, paupers or persons die because they have sold a kidney.¹⁶⁷

Finally, Calabresi and Melamed suggest that a protective paternalism supports non-commodification in instances where “a person may be better off if he is prohibited from bargaining.”¹⁶⁸

In a similar vein to Calabresi and Melamed, Richard Epstein has also sought to theorize inalienability.¹⁶⁹ He has suggested that non-commodification rules arise in response to “common pool” scenarios, which he describes as “those contexts in which one person is not the exclusive owner of a single resource, but shares it in indefinite proportions with other claimants.”¹⁷⁰ Epstein offers the example of a river, suggesting that unchecked individual privatization and commodification of the resource would be “unacceptable because it spells the end of a river qua river.”¹⁷¹

Finally, in her influential article *Market-Inalienability*, Margaret Jane Radin advanced three theories for why some resources might be considered inalienable and non-commodifiable.¹⁷² Radin terms these theories “a prophylactic argument, assimilation to prohibition, and a domino theory.”¹⁷³

Radin’s prophylactic argument is based on a concern that commodification of certain highly-personal resources will frequently arise in contexts of coercion or exploitation. She suggests that such commodification would be “so destructive of personhood” that we “should presume that such transactions are not the result of free choice” and thus should be banned.¹⁷⁴ Radin concludes that such a prophylactic argument justifies “prevent[ing] poor people from selling their children, sexual services, or body parts.”¹⁷⁵

166. *Id.* at 1111.

167. *Id.* at 1112.

168. *Id.* at 1113–14.

169. Richard A. Epstein, *Why Restrain Alienation?*, 85 COLUM. L. REV. 970, 978 (1985).

170. *Id.* at 973–74. In the same article, Epstein also discusses inalienability rules as justified based on prevention of harm to third parties, which is similar to Calabresi and Melamed’s externality explanation.

171. *Id.* at 979.

172. Margaret Jane Radin, *Market-Inalienability*, 100 HARV. L. REV. 1849, 1909 (1987).

173. *Id.* at 1909.

174. *Id.* at 1910.

175. *Id.* at 1910.

Radin's second argument, which she terms "assimilation to prohibition," suggests that commodified versions of some goods pollute, degrade, or otherwise cheapen the non-commodified versions of the same goods.¹⁷⁶ Radin reasons that "[i]f we accept that the commodified object is different from the 'same' thing noncommodified and embedded in personal relationships, then market-inalienability is a prohibition of the commodified version, resting on some moral requirement that it not exist."¹⁷⁷ To illustrate this point, Radin suggests that we do not allow people to commodify themselves, such as by selling themselves into slavery, because "we accept an inferior conception of personhood . . . if we suppose people may freely choose to commodify themselves."¹⁷⁸

Radin's third theory, her "domino theory," is premised on avoiding "a slippery slope leading to market domination."¹⁷⁹ This theory suggests that if one version of a good is commodified, then eventually all versions of that good will be commodified. She then reasons that if "the non-commodified version is morally preferable," then the commodified version must be prohibited so that it does not overtake all non-commodified versions.¹⁸⁰ She illustrates the concern in terms of prohibitions on commodification of sexual interactions, positing that "the existence of some commodified sexual interactions will contaminate or infiltrate everyone's sexuality so that all sexual relationships will become commodified."¹⁸¹

In *What's Wrong With a Parenthood Market? A New and Improved Theory of Commodification*,¹⁸² Professor Martha Ertman takes a more nuanced approach that embraces the fluidity of what could and should be commodified, depending on the views and understandings of values at stake.¹⁸³ For instance, she notes that Radin's opposition to commodification of parental rights might stymie the formation of families outside of a traditional heterosexual construct.¹⁸⁴ Nevertheless, she also recognizes the validity of Radin's concerns.

Interestingly, she foresees the argument, *infra*, about how costs of severance can affect commodification morality by noting that the buying and selling of gametes is treated differently than the buying and selling of actual babies though both are proxies for buying and selling parental rights.¹⁸⁵ Her recognition of "multivalent meanings" in markets generally argues against moral absolutes and opens the door for other explanations.¹⁸⁶

176. *Id.* at 1912.

177. *Id.*

178. *Id.*

179. *Id.*

180. *Id.* at 1913.

181. *Id.* at 1912–13.

182. Martha M. Ertman, *What's Wrong with a Parenthood Market? A New and Improved Theory of Commodification*, 82 N.C. L. REV. 1 (2003).

183. *Id.* at 4–5.

184. *Id.* at 3–4.

185. *Id.* at 6–7.

186. *Id.* at 5.

These works by Calabresi and Melamed, Epstein, Radin, and Ertman represent canonical theoretical considerations of inalienability and non-commodification, and all are can be categorized as observations regarding severance costs, adjustment failure costs, or both. Thus, the model can synthesize and explain all of them.

A. Severance Costs in Non-Commodification Theories

Most of the non-commodification theories discussed above react to relatively high severance-cost scenarios. Most apparently, severance costs underscore Radin's domino theory, which is premised on the idea that a commodified version of a good cannot be severed from the non-commodified version. This argument is explicit in her example that commodified sexual interaction may not be disentangled from non-commodified versions.¹⁸⁷ High severance costs describe the core of this objection to commodification.

With a small variation, this same analysis is applicable to Radin's prophylactic argument. While the domino theory rests upon the high cost of severing a commodified good from non-commodified versions of the same good, the prophylactic argument is premised on the high costs of severing highly personal goods from the would-be seller. A foundational premise of Radin's prophylactic argument is that highly personal resources (children, sexual services, and body parts) are, by their nature, an extension of the would-be seller.¹⁸⁸ Implicit in this premise is that there would be incredible severance costs associated with disaggregating the highly personal resource from the would-be seller herself. The prophylactic argument then reasons that because these severance costs would be so high to the would-be seller, any attempt at commodification (i.e., severance) must raise the suspicion of coercion or exploitation.

Another variation on the severance-cost concern is apparent in Radin's assimilation to prohibition argument as well as Calabresi and Melamed's "moralisms" argument. In these instances, the concern is rooted in the high cost of severing humans from their context in society.

For example, Radin's use of slavery (even self-slavery) to illustrate her assimilation to prohibition argument demonstrates a concern over the severance cost associated with removing humans from their societal context. The assimilation to prohibition theory starts from the premise that there is an extraordinarily high cost of separating the concepts of personhood associated with the non-commodified version of humans from the concepts of personhood associated with commodified humans. The argument then reasons that because this severance cost is so high, such severance will not take place, and the commodified version will

187. *Id.* at 45–47. This also explains why commodification of wetlands has risked erosion of mitigation sequencing, and, more broadly still, it shows the risk of all offset programs. Once something can be offset by cash payments, there is the temptation to view all such amenities or environments as fungible for cash.

188. *See* Radin, *supra* note 172, at 1910.

ultimately pollute the non-commodified version. To prevent this result, Radin argues, the commodified version should not exist. Essentially the argument asserts that because the concept of personhood of a human is bound up in society as a whole, the cost of severing this personhood concept from some humans is extraordinarily high. Because this high price is unlikely to be paid and severance will not actually occur, there cannot be commodified humans that would force such a reckoning.

Calabresi and Melamed's argument regarding "moralisms" demonstrates a concern with the same sort of prohibitive severance costs that would be associated with de-humanizing a member of society. To adopt Calabresi and Melamed's construct, the reason that Marshall may be harmed by Taney's self-commodification is because Taney cannot completely sever himself from his societal context (which happens to include Marshall). Marshall is injured "by seeing slaves, paupers or persons die because they have sold a kidney" because such instances occur within the community context that includes both Marshall and Taney, and Taney's attempts at commodification cannot overcome the severance costs that would be necessary to remove himself from such context.¹⁸⁹

Finally, high severance costs also underpin both Calabresi and Melamed's argument for non-commodification to avoid externalities as well as Epstein's arguments for non-commodification to avoid harms to common-pool resources. Both arguments suggest that certain goods cannot be commodified and removed from their context without causing some harm, whether in the form of externalities to third parties or damage to common pools. For example, to use Epstein's illustration, the commodification and sale of river water cannot be severed from its impacts on the river as a whole. The high severance costs involved mean that external impacts cannot be fully internalized because the impacts cannot be divorced from their broader context.

B. Adjustment Failure Costs in Non-Commodification Theories

In addition to high severance costs, the non-commodification theories also react to high adjustment failure cost scenarios. To take an obvious example, Epstein's common pool argument is explicitly concerned with adjustment failure costs similar to those discussed in Part II regarding environmental resources. Epstein's common-pool argument cautions that commodification of common-pool resources may lead to extremely costly or irreparable results, such as "spel[ling] the end of a river."¹⁹⁰

In addition to adjustment failure costs associated with harm to external, physical environments, the non-commodification literature also shows an overarching concern with adjustment failure costs associated with impacts on

189. See Calabresi & Melamed, *supra* note 165, at 1112.

190. See Epstein, *supra* note 169, at 979; see also *id.* at 978 (noting that "the potential long-term effects [of overexploiting common pools] can be extremely costly").

humans and societies. For example, Radin's and Calabresi and Melamed's arguments raise issues of personhood, individuality, and self-determination, and such values are definitionally non-fungible and likely irreparable. As a result, these arguments sound against a background of high adjustment failure costs, and such costs are brought to the fore when contextualized in terms of selling children, sexual services, body parts, or self-enslavement. These are high-stakes scenarios, and arguments against their commodification demonstrate a fundamental discomfort with leaving the governance of such unique instances to the trial-and-error process of the market.

While the specter of high adjustment failure costs looms in all of these arguments, Radin's prophylactic argument and Calabresi and Melamed's protective paternalism argument provide particular opportunities to develop these adjustment failure cost concerns. For example, Radin's prophylactic argument protects against potential coercion and *exploitation* involved in, for instance, "poor people . . . selling their children, sexual services, or body parts."¹⁹¹ Obviously, such sales would involve non-fungible and irreparable "goods" that implicate a great and lasting sacrifice of personhood. This alone implicates high adjustment failure costs, but there is an additional point of concern. In these instances the adjustment failure costs involved may also mean that the would-be seller would not even receive adequate value for such a sacrifice. This worry over value underscores the particular concern over exploitation, and the high adjustment failure costs involved can exacerbate that worry.

The adjustment failure costs of these situations can rise based not only on the irreparability of the underlying goods but also because their unique nature can impact the levels of market participation. It may be that transactions for such unique commodities are relatively rare, and, even more likely, sellers within these markets will not be frequent repeat participants. To use a hypothetical illustration, there may not be all that many children sold in a given year, and any one individual is unlikely to have more than one to sell.¹⁹² So, there may be relatively little market information available to sellers, what is available will have only limited applicability because the underlying goods are unique, and sellers (and potentially buyers) will be faced with one-shot deals. As such, sellers (or buyers) will not necessarily have the advantage of the error-correction that can take place from longer participation in a robust, competitive market. Rather, individuals will likely be stochastic participants, and they will risk sacrificing elements of their personhood at the low end of price-pendulum swings, particularly if they are coerced to sell by conditions of poverty.

Of course, the situation might be otherwise. Sellers could be relatively uncoerced, they could have ample information about prices, they may catch the high end of price-pendulum swings, and markets may be robust and competitive.

191. See Radin, *supra* note 172, at 1910.

192. This hypothetical assumes initial sales. It is certainly possible that a middleman could buy children from many parents and then serve as a clearinghouse to sell them.

However, given the unique goods at stake (as well as the worries over coercion), there is the risk that sellers of such unique, personal goods will get the short end of a market transaction. It is this risk that adds an additional element of adjustment failure costs to these transactions, and it is this risk that inform concerns over exploitation that are apparent in Radin's prophylactic argument. Similarly, it is the same high adjustment failure cost scenarios that help explain Calabresi and Melamed's protective paternalism argument that in some instances individuals may be better off if prohibited from bargaining. In both cases, the adjustment failure costs inherent in the goods raise concerns that sales will create irreparable harms because sellers will not receive adequate compensation for the sacrifices they undertake.

In sum, the severance cost/adjustment failure cost model offers a unifying framework that synthesizes major non-commodification theories. In doing so, it offers a descriptive thread consistent across the theories, and it identifies an economic underpinning for moral arguments.

CONCLUSION

By identifying and examining severance costs and adjustment failure costs, this Article constructs a broadly applicable model for considering the emergence and success of markets. The insights from this model can be applied on a practical level to inform deployment of market-based approaches to environmental governance. Additionally, the insights of the model can inform other governance debates, such as in the contexts of markets for human tissues or licensure requirements for professions and platforms. Finally, the model contributes to theoretical understanding of commodification by synthesizing prevailing non-commodification theories.

