

CAPITAL RIGIDITIES, LATENT EXTERNALITIES

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Introduction ..... 2  
I. What is Capital? ..... 8  
II. How Capital Impedes Reform..... 15  
    A. Overcapitalization as a Drag on Environmental Reform ..... 16  
    B. A Model of How Capital Impedes Reform ..... 18  
III. The Role of Law and Lawmaking in Promoting and Protecting  
Capital..... 22  
    A. Tax Benefits for Energy Industries ..... 23  
    B. Tax Benefits for Mining Industries ..... 30  
    C. Electric Utility Regulation ..... 32  
    D. Grandfathering..... 36  
    E. Regulatory Takings Jurisprudence ..... 40  
    F. The Politics of Human and Social Capital ..... 44  
IV. Whither, Capital? A Refocus on Public Goods ..... 47  
Conclusion..... 53

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CAPITAL RIGIDITIES, LATENT EXTERNALITIES

*Abstract*

*Capital, one of two fundamental inputs to production, is critical to economic growth. As such, legal rules and institutions generally seek to create more of it, and also seek to protect existing capital from policy changes. However, capital is often durable, and during its natural life, information may emerge pointing to negative externalities resulting from operation of that capital. Legal rules and institutions, in seeking to stimulate and sustain economic growth by promoting and protecting capital, thus tend to induce the creation of excess capital. This abundance of capital creates excess resistance to new regulation or policy reform, as capital owners will have a larger capital stake to defend, and will expend more resources to resist changes in their legal and economic environment.*

*This theory of capital has special application to environmental externalities, which are commonly latent. Capital is thus almost always obtained with incomplete information about potential environmental externalities. Environmental law is the means by which many previously unforeseen externalities are sought to be addressed, but any change in environmental law is invariably challenged by capital owners. By enacting legal rules to promote and protect capital, developed societies have unwittingly erected larger barriers to environmental reform. Over time, environmental law has become more difficult to reform, and the source of more litigation.*

INTRODUCTION

Capital is good. Capital and labor are the two stylized inputs to production.<sup>1</sup> Among economists, capital is universally regarded as positively related to economic growth.<sup>2</sup> If one asks (as numerous economists have asked) the

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1 The Cobb-Douglas production function, which every economics student learns about in undergraduate economics, posits production as a function of the quantity and productivity of just two types of inputs: labor and capital. Charles W. Cobb & Paul H. Douglas, *A Theory of Production*, 18 (supplement) AM. ECON. REV. 139 (1928). The now-familiar Cobb-Douglas formulation,  $Y = AL^\alpha K^\beta$ , with  $Y$  representing output,  $L$  representing labor, and  $K$  representing capital, is a foundational relation in economic theory.

2 Robert Solow's fundamental neoclassical growth model posits growth as a general function of labor, capital, and technology, the latter being a multiplier that makes the other two inputs more productive. Robert M. Solow, *A Contribution to the Theory of Economic Growth*, 70 Q. J. ECON. 65 (1956). See, also, George N. Hatsopoulos, Paul R. Krugman, and Lawrence Summers, *U.S. Competitiveness:*

complicated question of why some countries are so much richer and produce so much more than others, one can easily rule out the availability of labor as a limiting input, since most developing countries are awash in cheap labor.<sup>3</sup> What is left? Capital.<sup>4</sup> Furthermore, more capital is always better. Additional capital may or may not be worth its cost, but it never *decreases* productivity.<sup>5</sup>

Capital is good, except when it isn't. After capital is acquired, new information may emerge suggesting that the capital might not be so useful after all. The new information may reveal some harmful effects of operating that capital, and may indicate that continued employment of that capital produces net social harms. Or, the new information may suggest that capital is outdated, and that other forms of capital or other technologies would be more efficient and produce greater net social benefits. In short, new information can render existing capital obsolete in a number of different ways, most notably by revealing the presence of latent negative externalities. But even obsolete capital can be extremely difficult to dislodge. Unless obsolete capital can be profitably redeployed, attempts to

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*Beyond the Trade Deficit*, 241 SCIENCE 299, 301-02 (1988) (arguing for a broader definition of capital to explain relative American lagging in productivity growth); N. Gregory Mankiw, *The Growth of Nations*, 1995 BROOKINGS PAPERS ON ECONOMIC ACTIVITY 275, 292 (1995).

3 See, e.g., Adrian Wood, *Openness and Wage Inequality in Developing Countries: The Latin American Challenge to East Asian Conventional Wisdom*, 11 WORLD BANK ECON. REV. 33, 34 (1997) ("The belief that increased openness reduces wage inequality in developing countries rests on an apparently indisputable fact—that the supply of unskilled labor, relative to the supply of skilled labor, is larger in developing than in developed countries."); Michael P. Todaro, *A Model of Labor Migration and Urban Employment in Less Developed Countries*, 59 AM. ECON. REV. 138, 138 (1969) ("[E]ven the most casual observer of these countries cannot help but be overwhelmed by the proportion of the labor force which is apparently untouched by the 'modern' economy.).

4 Also, technology, which in the Cobb-Douglas and Solow formulations act as a multiplier for labor productivity and capital productivity, but is not considered an input for productivity. See, e.g., Richard R. Nelson and Edmund S. Phelps, *Investment in Humans, Technological Diffusion, and Economic Growth*, 56 AM. ECON. REV. 69, 71 (1966); Paul Krugman, *A Model of Innovation, Technology Transfer, and the World Distribution of Income*, 87 J. POL. ECON. 253, 254 (1979).

5 Idiosyncratic exceptions may exist, but the Cobb-Douglas production function is almost never deployed with capital having an inverse relationship with productivity.

## LATENT EXTERNALITIES

regulate or internalize externalities<sup>6</sup> resulting from the operation of capital will be vigorously opposed by its owners.

This theory of capital has special application to environmental externalities, which are by their nature commonly latent. The most serious environmental problems are no longer obvious and visceral. Leaky industrial drums sitting atop playgrounds are no longer the symbol of environmental blight. The focus of environmental law has turned towards less visible problems, such as the emission of carbon dioxide causing global climate change,<sup>7</sup> and the emission of fine particulate matter – less than 2.5 microns in diameter – quietly causing millions of premature deaths annually.<sup>8</sup> But these kinds of environmental problems only become apparent after decades of careful and credible research. In the meantime, billions of dollars of capital may accumulate without any serious attempt to consider the possibility of latent externalities.

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6 An externality is a general term for an effect of a decision, on a party other than the decision-maker, that the decision-maker does not take into account. For a discussion, see Carl J. Dahlman, *The Problem of Externality*, 22 J. L. & Econ. 141 (1979).

7 For a relatively brief treatment of this extremely broad, complex, and literature-heavy problem, see ROBERT HENSON, *A ROUGH GUIDE TO CLIMATE CHANGE* (3d ed. 2012).

8 An extremely sophisticated body of epidemiological research has emerged over decades of careful research linking concentrations of fine particulate matter with premature mortalities. See, e.g., Francine Laden et al., *Reduction in Fine Particulate Air Pollution and Mortality: Extended Follow-up of the Harvard Six Cities Study*, 173 AM. J. RESPIRATORY AND CRITICAL CARE MED. 667, 668-69 (2006) (finding that for every 10  $\mu\text{g}/\text{m}^3$  increase in fine-particulate matter pollution resulted in an increase in premature deaths to be on the order of 3% higher (Table 1); Johanna Lepeule, Francine Laden, Douglas Dockery, and Joel Schwartz, *Chronic Exposure to Fine Particles and Mortality: an Extended Follow-up of the Harvard Six Cities Study from 1974 to 2009*, 120 ENVIR. HEALTH PERSP. 965 (2012); C. Arden Pope III et al., *Lung Cancer, Cardiopulmonary Mortality, and Long-term Exposure to Fine Particulate Air Pollution*, 287 J. AM. MED. ASS. 1132 (2002). Recent studies have estimated that fine particulate matter pollution cause over two million premature deaths annually, Raquel A. Silva, et al, *Global Premature Mortality Due to Anthropogenic Outdoor Air Pollution and the Contribution of Past Climate Change*, 8 Env. Res. Letters 034005 (2013), and 1.2 million deaths in China alone, Edward Wong, *Early Death Linked China's Air Pollution Totaled 1.2 Million in 2010, Data Shows*, N.Y. Times, April 1, 2013, at A9; online: <http://www.nytimes.com/2013/04/02/world/asia/air-pollution-linked-to-1-2-million-deaths-in-china.html>.

Reform or new legislation leading to resolution of modern environmental problems has thus been elusive, well before Congress reached its current state of gridlock. No new federal environmental statute has passed Congress since 1990,<sup>9</sup> despite the existence of a number of under-regulated industries.<sup>10</sup> Prevailing explanations for this inertia in these areas of law fall broadly into three categories: (i) public choice explanations,<sup>11</sup> (ii) framing problems,<sup>12</sup> and (iii) doubts about the importance of the underlying

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9 This author considers the last significant federal environmental legislation passed by Congress to be the Clean Air Act Amendments of 1990, Pub. L. No. 101-549, 104 Stat. 2399 (codified as amended at 42 U.S.C. §§ 7401–7671q (2012)).

10 Whether certain industries and industrial practices are truly more harmful than productive is of course a challenging question to answer, but an important recent analysis suggests good reason to suspect there are many such industries. Nicholas Z. Muller, Robert Mendelson, and William Nordhaus *Environmental Accounting for Pollution in the United States Economy*, 101 AM. ECON. REV. 1649 (2012). Using integrated assessment models, which model environmental impacts and economics impacts together, an analysis of the net gross external damages of all point-source polluters of all pollutants in the United States Muller, Mendelson, and Nordhaus find that their best estimates of gross external damages of seven industries exceed their contribution to economic activity. Those industries are stone quarrying, solid waste incineration, sewage treatment plants, oil- and coal-fired power plants, marinas, and petroleum-coal product manufacturing. Given the somewhat restrictive assumptions in this study about, for example, non-market damages to ecological systems, one suspects that there are many more than seven industries that are more harmful than valuable.

11 For example, one common public choice explanation is that intensely-affected regulated industries are more motivated to resist reform than lightly-affected and widely-dispersed majorities are to advance reform. If that is the case, then one might expect the politics of policy change to favor inertia. JAMES M. BUCHANAN AND GORDON TULLOCK, *THE CALCULUS OF CONSENT: LOGICAL FOUNDATIONS OF CONSTITUTIONAL DEMOCRACY* (1962); George J. Stigler, *The Theory of Economic Regulation*, 2 J. ECON. & MGMT. SCI. 1, 3 (1971). Another public choice explanation might be that agency actors and the industries they regulate will have repeat interactions. If that is the case, then one would expect patterns of cooperation which might, in the face of policy change, give rise to a systemic resistance to change, lest that upset a status quo that benefits both regulator and regulated industry. IAN AYRES & JOHN BRAITHWAITE, *RESPONSIVE REGULATION: TRANSCENDING THE DEREGULATION DEBATE*, ch. 3 (1992).

12 For example, within the category of framing problems, one explanation could be that the costs of environmental policy are more easily identified and visualized than the environmental benefits, which tend to take on statistical forms. Shi-Ling Hsu, *The Identifiability Bias in Environmental Law*, 35 FLA. ST. UNIV. L. REV. 433 (2008).

## LATENT EXTERNALITIES

problem.<sup>13</sup> While all of these explanations have some explanatory power, a theory of how capital impedes energy and environmental policy reform is the most broadly applicable. This article sets forth a theory that is more specific than most public choice explanations, and broader than most psychological explanations. Just about every proposed reform to address a latent environmental problem has emerged in the middle of the economic life of some form of capital, and posed a threat to some individual, firm, or industry that had capital invested in the status quo. Every proposed reform of significance creates losers; this article explains how they lose, and how much they will resist losing. If the continued exploitation of capital creates latent externalities that were not appreciated (or were consciously ignored) at its time of formation, a split in interests emerges: cessation of use of the capital may be desirable from the social point of view, but the owner of the capital will want to continue to use the capital. This simple story is, in part, the story of almost every latent externality ever created.

A particularly salient example of this dynamic revolves around coal-fired electricity generation. Long-lived industrial capital such as coal-fired power plants played an important role in generating wealth throughout the world by providing low-cost electricity.<sup>14</sup> The low costs were made possible by abundant supplies of coal that could be extracted at relatively low costs.<sup>15</sup> Thousands of coal-fired power plants were built, and a vast extraction and distribution network was built to mine coal and deliver it to these power plants.<sup>16</sup> Over time, however, a great deal of information has emerged suggesting that although the private costs of mining and burning coal are low, these direct costs are swamped by the social and environmental costs of coal mining and combustion.<sup>17</sup> Also, new technologies and new sources

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13 There are obviously conflicting accounts of whether the science of climate change is sufficient or not, but most informed observers of the climate change debate would agree that the risk of inaction is unjustifiable. A summary of the controversy can be found in Shi-Ling Hsu, *A Prediction Market for Climate Outcomes*, 83 U. COLO. L. REV. 179, 181-89 (2011).

14 For a general history of coal, see BARBARA FREESE, *COAL: A HUMAN HISTORY* (2003).

15 FREESE, *supra*, note 14, at 6-7.

16 FREESE, *supra*, note 14, at 118-26.

17 Epidemiological work undertaken over decades has shown that by far, the greatest cost of coal combustion is in the human toll of premature deaths occurring due to fine particulate matter emissions. See, e.g., Francine Laden et al., *Reduction in Fine Particulate Air Pollution and Mortality: Extended Follow-up of the Harvard Six Cities Study*, 173 AM. J. RESPIRATORY AND CRITICAL CARE MED. 667, 668-69 (2006) (finding that for every 10  $\mu\text{g}/\text{m}^3$  increase in fine-particulate matter pollution resulted in an increase in premature deaths to be on the order of 3% higher

of energy (most prominently natural gas) have emerged suggesting that coal is not even the cheapest fossil fuel for generating electricity.<sup>18</sup> But the sprawling network of coal production, distribution, and combustion is fixed. It cannot be easily redeployed in a low-carbon economy.<sup>19</sup> This capital rigidity has created a huge number of parties with a tremendous stake in its continued existence.

This article sets out a theory of capital that explains how legal rules and institutions create resistance to reform, especially attempts to address environmental externalities. Part I of this article sets out a working definition of the term "capital." This part will also briefly describe the three different types of capital considered in this article: physical, human, and social capital. Part II of this article sets out examples of how capital

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(Table 1); Johanna Lepeule, Francine Laden, Douglas Dockery, and Joel Schwartz, *Chronic Exposure to Fine Particles and Mortality: an Extended Follow-up of the Harvard Six Cities Study from 1974 to 2009*, 120 ENVIR. HEALTH PERSP. 965 (2012); C. Arden Pope III et al., *Lung Cancer, Cardiopulmonary Mortality, and Long-term Exposure to Fine Particulate Air Pollution*, 287 J. AM. MED. ASS. 1132 (2002). For an estimate of the total damages from coal combustion, see, Nicholas Z. Muller, Robert Mendelson, and William Nordhaus *Environmental Accounting for Pollution in the United States Economy*, 101 AM. ECON. REV. 1649, 1665 (Table 2) (2012) (using the Laden et al study, and showing, using integrated assessment economic models, external damages of \$53.4 billion, 2.2 times the value-added of coal-fired electricity generation); Roberta Mann in *Another Day Older and Deeper in Debt: How Tax Incentives Encourage Burning Coal and the Consequences for Global Warming*, 20 PACIFIC MCGEORGE GLOBAL BUS. & DEVELOPMENT L. J., 111, 118-25 (2006).

<sup>18</sup> Natural gas has long been known to be less polluting than coal, and at least in the environmental sense a superior fossil fuel. U.S. Environmental Protection Agency, *Electricity from Natural Gas*, <http://www.epa.gov/cleanenergy/energy-and-you/affect/natural-gas.html> (last updated October 17, 2012). More recently, the emergence of hydraulic fracturing technology has rendered natural gas inexpensive enough to rival coal as the fuel of choice for electricity generating firms. See, e.g., U.S. Department of Energy, Energy Information Administration, *Electric Power Monthly*, September, 2012 (2012), online: [http://www.eia.gov/electricity/monthly/epm\\_table\\_grapher.cfm?t=epmt\\_1\\_01](http://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_1_01) (showing net generation from natural gas approaching that of coal).

<sup>19</sup> Coal-fired power plants can be converted to natural gas-fired power plants, but the conversion is usually too costly and difficult. See, e.g., Eric Williams, Rich Lotstein, Christopher Galik & Hallie Knuffman, *A Convenient Guide to Climate Change Policy and Technology*, Nicholas School for Environmental Policy Solutions and the Center on Global Change, Duke University 37-42 (2007) (estimating repowering costs of \$1590 per kW of capacity, and \$1700 per kW for new construction of a comparable natural gas-fired power plant); online: <http://www.nicholas.duke.edu/ccpp/convenientguide/PDFs/ClimateBook.pdf>.

## LATENT EXTERNALITIES

impedes reform attempting address latent externalities. Part III will explain how current laws and governmental structures either over-promote the formation of capital, or over-protect it once it is formed or acquired. Part IV argues for a refocusing of government subsidies on true public goods. Specifically, this part argues that government policy should focus more on network goods, and not just capital projects that lower commodity prices. This article then concludes with some general observations on laws affecting the formation and protection of capital.

### I. What is Capital?

The term "capital" has an almost universally positive connotation.<sup>20</sup> A fair amount of government policy seems to be oriented towards promoting the formation and acquisition of capital. Scattered liberally throughout the Internal Revenue Code are generous provisions to assist with the formation and acquisition of capital,<sup>21</sup> especially for small businesses.<sup>22</sup> President Obama's economic stimulus packages of 2008<sup>23</sup> and 2009<sup>24</sup> included a temporary provision to allow an increased tax deduction for capital

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20 U.S. House of Representatives, *The Future of Capital Formation: Hearing before the Committee on Oversight and Government Reform* 112 Cong. 46 (2011) ("Facilitating capital formation, along with protecting investors and maintaining fair, orderly and efficient markets, is the mission of the SEC. Cost-effective access to capital for companies of all sizes plays a critical role in our national economy, and companies seeking access to capital should not be overburdened by unnecessary or superfluous regulations." Statement of Mary Schapiro, before Committee on Oversight and Government Reform, House of Representatives), online: <http://www.gpo.gov/fdsys/pkg/CHRG-112hhrg70517/pdf/CHRG-112hhrg70517.pdf>. Also, Section 2 of the Securities Act of 1933 provides, in part:

(b) Consideration of promotion of efficiency, competition, and capital formation  
Whenever pursuant to this subchapter the Commission is engaged in rulemaking and is required to consider or determine whether an action is necessary or appropriate in the public interest, the Commission shall also consider, in addition to the protection of investors, whether the action will promote efficiency, competition, and capital formation.  
15 U.S.C. § 77b(b).

21 See, e.g., Robert E. Hall and Dale W. Jorgenson, *Tax Policy and Investment Behavior*, 57 Am. Econ. Rev. 391, 391 (1967).

22 See, e.g., Douglas Holtz-Eakin, *Public Policy Toward Entrepreneurship*, 15 Small Bus. Econ. 283, 288-89 (2000).

23 Economic Stimulus Act of 2008, Publ. L. No. 110-185, 122 Stat. 613 (2008).

24 American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5, 123 Stat. 115 (2009).

equipment purchased through 2013.<sup>25</sup> There is even a Washington-based advocacy group that extols the virtues of capital formation for its own sake, the American Council for Capital Formation.<sup>26</sup> The worship of capital may be even more pronounced in capital-poor developing countries, for which prescriptions center upon making capital more available.<sup>27</sup> It is the formation of capital, everyone seems to believe, that creates low commodity prices and broadly-distributed benefits, unleashing the industry and entrepreneurship of individuals and firms in an economic society.

And yet, despite our universal admiration for capital, a precise and widely-accepted definition of capital is elusive. Adam Smith defined it as "[his] stock .... which, he expects, is to afford him his revenue."<sup>28</sup> In a similar vein, Robert Solow has defined it in passing as generically, a "stock of produced or natural factors of production that can be expected to yield productive services for some time."<sup>29</sup> Gregory Mankiw posits capital as current consumption foregone to produce more income tomorrow.<sup>30</sup> Undergraduate textbooks simply model production as a function of just two types of inputs: capital and labor.<sup>31</sup> This dichotomy is a gross

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25 Sec. 103, Economic Stimulus Act of 2008, *supra*, note 23, 26 U.S.C. §168(k); Sec. 1201, American Recovery and Reinvestment Act of 2009, *supra*, note 24, 26 U.S.C. §168(k).

26 American Council for Capital Formation, url: <http://www.accf.org/home.php>.

27 Hernando de Soto's *Mystery of Capital* propounds a theory that people in developing countries fail to accumulate wealth because their property cannot be leveraged as capital the way that they are in developed countries. HERNANDO DE SOTO, *THE MYSTERY OF CAPITAL* 5 (1999). Muhammad Yunus won a Nobel Peace Prize for his pioneering work in the business of microfinance in poor communities, making small loans to collateral-poor entrepreneurs. World Resources Institute, *Microfinance Entrepreneur Receives Nobel Prize*, October 13, 2006, online: <http://www.wri.org/stories/2006/10/microfinance-entrepreneur-receives-nobel-prize>.

28 ADAM SMITH, *AN INQUIRY INTO THE NATURE AND CAUSES OF THE WEALTH OF NATIONS* 351 (1776).

29 Robert M. Solow, *Notes on Social Capital and Economic Performance*, 6 (in *SOCIAL CAPITAL: A MULTIFACETED PERSPECTIVE* 6-9, P. Dasgupta and I. Serageldin, eds., 2000).

30 N. Gregory Mankiw, *The Growth of Nations*, 1995 BROOKINGS PAPERS ON ECONOMIC ACTIVITY 275, 293 (1995) ("More generally, however, we accumulate capital whenever we forgo consumption today in order to produce more income tomorrow.").

31 The now-familiar Cobb-Douglas formulation,  $Y = AL^{\alpha}K^{\beta}$ , is a relation which every economics student learns about in undergraduate economics, posits production as a function of the quantity and productivity of just two types of inputs:

oversimplification, of course. Labor is required to build the capital in the first place; in that sense, capital can simply be thought of as stored labor.<sup>32</sup>

These and a number of other definitional complexities have led to some more conceptual and less rigid formulations of capital. Gary Becker has, in his seminal work, married labor and capital into "human capital" to denote the amount of human training and education that is undertaken to produce other things (or services).<sup>33</sup> Indeed, a broad notion of capital is central to the thesis of this article, as the mystery of how capital retards environmental policy reform can only be unlocked when considering the many forms of capital invested in polluting behavior.

This article sets forth a working definition that does not seek to bridge or synthesize differences among the economic giants that have considered this topic. For purposes of this article, I define capital as *a long-lived asset that generates a stream of benefits*. Capital is long-lived in the sense that it is meant to be durable and undergo sustained use over a period of time or more generally, over a quantity of production. Capital generates a stream of benefits because that is why it is obtained in the first place.<sup>34</sup>

Capital is not necessarily costly. In some cases, capital is accumulated without effort or cost. But even in such cases of windfall capital, defense can be as vigorous as that of costly capital. The costliness of capital may, for psychological reasons, inspire more spirited defense, but for purposes of this article, is not a predicate to the points made in this article.

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labor ( $K$ ) and capital ( $L$ ). Charles W. Cobb, and Paul H. Douglas, *A Theory of Production*, 18 (supplement) AM. ECON. REV. 139 (1928). Robert Solow's fundamental neoclassical growth model posits growth as a general function of labor, capital, and technology, the latter being a multiplier that makes the other two inputs more productive. Robert M. Solow, *A Contribution to the Theory of Economic Growth*, 70 Q. J. ECON. 65 (1956).

32 Hernando deSoto notes that capital must be "fixed and realized in some particular subject which lasts for some time at least after that labor is past. It is, as it were, a certain quantity of labour stocked up and stored to be employed, if necessary upon some future occasion." HERNANDO DE SOTO, *THE MYSTERY OF CAPITAL* 42 (1999).

33 GARY S. BECKER, *A THEORETICAL AND EMPIRICAL ANALYSIS, WITH SPECIAL REFERENCE TO EDUCATION* 17 (3d ed., 1993) ("Education and training are the most important investments in human capital.").

34 See, e.g., Franco Modigliani and Merton H. Miller, *The Cost of Capital, Corporation Finance, and the Theory of Investment*, 48 AM. ECON. REV. 261, 265 (1958).

I consider three kinds of capital: physical, human, and social.<sup>35</sup> There are many other kinds of assets to which the label of "capital" has been attached.<sup>36</sup> But these three forms of capital, as I describe them below, are the forms of capital that have played a prominent role in retarding policy reform to address latent environmental externalities.

*Physical capital* is capital that takes on a tangible, physical form. For example, a power plant, with a useful life of at least forty years,<sup>37</sup> is an asset that generates a stable stream of revenues in the form of consumer electricity payments. Indeed, ensuring that environmental regulation does not threaten the size or the continuity of that stream of benefits occupies a considerable amount of attention from the owners of that capital. A stable regulatory and price environment is the ideal environment, if not the *sine qua non* of the investment of such capital. The costliness of physical capital such as a power plant,<sup>38</sup> coupled with the long time horizons involved with in paying for such capital,<sup>39</sup> lends urgency to the task of monitoring and

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35 Many scholars consider social capital to be a recent addition to the three previous widely-accepted forms of capital: physical, human, and natural. *See, e.g.*, Elinor Ostrom, *Social Capital: a Fad or Fundamental Concept?* 172-214, 172-79, in Dasgupta and Serageldin, *supra*, note 29; and Norman Uphoff, *Understanding Social Capital: Learning from the Analysis and Experience of Participation*, 215-249, in Dasgupta and Serageldin, *supra*, note 29.

36 Natural resources and environmental conditions can constitute "natural capital." *See, e.g.*, Ostrom, *supra*, note 35, at 172. Capital can also be financial. The term "capital markets" is commonly used to refer to equity markets, or stock markets, in which invested monies is hoped to generate a future benefit in the form of a stock dividend or an increased share value over time. *See, e.g.*, Eugene F. Fama, *Efficient Capital Markets: A Review of Theory and Empirical Work*, 25 J. FINANCE 383 (1970).

37 For example, a recent regulation by Environment Canada to apply a new emissions performance standard for coal-fired power plants "at the end of their useful life" assumed a useful life of a power plant to be forty-five years. Reduction of Carbon Dioxide Emissions from Coal-Fired Generation of Electricity Regulations, *Canada Gazette* Vol. 145, No. 35, at 14 (August 27, 2011).

38 Coal-fired power plants that would enter service in 2018 would have an average "overnight" capital cost of \$2,833 to 3,167 per kilowatt of capacity (*see*, U.S. Department of Energy, Energy Information Administration, Updated Capital Cost Estimates for Electricity Generation Plants 7 (Table 1) (2010), online: [http://www.eia.gov/oiaf/beck\\_plantcosts/pdf/updatedplantcosts.pdf](http://www.eia.gov/oiaf/beck_plantcosts/pdf/updatedplantcosts.pdf)) The overnight capital cost of a power plant is the cost to replace it.

39 As a crude order-of-magnitude calculation, assuming a capacity rate of 85% (meaning that the plant runs at an average long-term capacity of 85%, an assumption made by the U.S. Department of Energy in calculating capital costs; *see*, U.S. Department of Energy, Energy Information Administration, Annual

managing, to the greatest extent possible, the regulatory and price environments.

*Human capital* is most often thought of as education and training.<sup>40</sup> Generally speaking, the higher the education, the greater the value of the human capital.<sup>41</sup> Education can be costly, not only because of direct costs, but because of the opportunity costs of foregone income.<sup>42</sup> Indisputably, human capital is valuable, as productivity is observed to be clearly and consistently greater in the presence of human capital.<sup>43</sup> Thus human capital is, by itself, something that generates a stream of benefits, in the form of earnings that would not otherwise be realized.

Importantly, human capital need not be formal. While human capital is most easily conceived as formal schooling or on-the-job training,<sup>44</sup> there are clearly many other forms of human capital. Human capital may be the

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Energy Outlook 2013 4 (Table 1), online: [http://www.eia.gov/forecasts/aco/er/pdf/electricity\\_generation.pdf](http://www.eia.gov/forecasts/aco/er/pdf/electricity_generation.pdf)), a 500-megawatt power plant would generate 425 megawatt-hours every hour, every day, or 3,723,000 megawatt-hours per year. Using the average 2011 nationwide retail price of electricity, \$88.10 per megawatt-hour (see, U.S. Department of Energy, Energy Information Administration, Annual Energy Review 2011 255 (Table 8.10) (2012), online: [http://www.eia.gov/totalenergy/data/annual/pdf/sec8\\_39.pdf](http://www.eia.gov/totalenergy/data/annual/pdf/sec8_39.pdf)), and subtracting off average operations and maintenance costs of \$35.09 per megawatt-hour (see U.S. Department of Energy, Energy Information Administration, Electric Power Annual 2011 (Table 8.4) (2012), online: <http://www.eia.gov/electricity/annual/pdf/epa.pdf>), it would take 7.8 years to pay back the capital costs. Of course, this crude calculation omits many other costs, factors and variables, including finance costs, transmission costs, and other expenses associated with running a power plant.

40 GARY S. BECKER, A THEORETICAL AND EMPIRICAL ANALYSIS, WITH SPECIAL REFERENCE TO EDUCATION 17 (1994).

41 *Id.* at 170 (Table 4, showing income differentials for high school and college graduates), 224 (Table 17, showing higher incomes for college graduates). Although the *marginal* returns to a college education have not always been historically higher than the *marginal* returns to high school education, the marginal returns to college education have always been positive. See also, CLAUDIA GOLDIN AND LAURENCE KATZ, THE RACE BETWEEN EDUCATION AND TECHNOLOGY 78-79 (Table 2.5, showing positive returns to college schooling) (Harvard Univ. Press, 2008).

42 See, e.g., Theodore W. Schultz, *Capital Formation by Education*, 68 J. POL. ECON. 571 (1960).

43 BECKER, *supra*, note 33, at 59; Theodore W. Schultz, *Investment in Human Capital*, 51 AM. ECON. REV. 1 (1961).

44 For example, Becker's original empirical work focuses on the measurable benefits of schooling and on-the-job training. BECKER, *supra*, note 33, at 17-21.

acquired knowledge of some facet of resource extraction, or some operational expertise connected to a specific industrial process. The acquisition of human capital may not be part of any organized effort at all; Microsoft co-founder Bill Gates and Apple co-founder Steve Jobs, both college dropouts, owe a considerable amount of their success to human capital they acquired at early, formative stages of life.<sup>45</sup> In almost all cases, human capital requires significant costs to obtain, has the potential to be long-lived, and can generate a long-lived stream of benefits.

Finally, *social capital*, as it is conceived in this article, consists of the variety of interpersonal and intra-organizational bonds that are formed when one signals to another that cooperation is sought. Among economists, there is some controversy as to whether the term "capital" can be coherently applied to something like the social interactions that make up what is popularly referred to as social capital.<sup>46</sup> For those economists that engage with the concept of social capital, the focus is typically on how it increases productivity. After all, what good would social capital be, apart from the psychological benefits of social belonging?<sup>47</sup> If social capital is to have economic content, then it must have a role in economic performance.

What is different about social capital is that the social interactions that make up social capital do not primarily have economic motivations. The concept of social capital thus draws heavily from the work of Robert Putnam's *Bowling Alone*,<sup>48</sup> which chronicles the decline of social institutions in the United States, the result of which is a lack of a social fabric that made many

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45 MALCOLM GLADWELL, *OUTLIERS: THE STORY OF SUCCESS* 15-22 (2008) (describing the unusual early opportunities that Gates had to work on computer programs. For example: "[t]hose five years, from eighth grade through the end of high school, were Bill Gates's Hamburg, and by any measure, he was presented with an ... extraordinary series of opportunities...." *Id.*, at 18.); WALTER ISAACSON, *STEVE JOBS* 3-20 (2011).

46 *See, e.g.*, Kenneth Arrow, *Observations on Social Capital*, 3-5 in *SOCIAL CAPITAL: A MULTIFACETED PERSPECTIVE* (P. Dasgupta and I. Serageldin, eds., 2000), and Robert M. Solow, *supra*, note 29.

47 Economists argue that joining social networks have non-economic benefits, and are at least in part the motivation for joining. *See, e.g.*, Arrow, *supra*, note 46, at 3 ("There is considerable consensus also that much of the reward for social interactions is intrinsic – that is, the interaction is the reward—or at least that the motives for interaction are not economic. People may get jobs through networks of friendship or acquaintance, but they do not, in many cases, join the networks for that purpose.")

48 ROBERT D. PUTNAM, *BOWLING ALONE: THE COLLAPSE AND REVIVAL OF AMERICAN COMMUNITY* (1995).

## LATENT EXTERNALITIES

cooperative endeavors possible in the past. Putnam's argument is that social networks enhance political and civic life without consciously having these outcomes as objectives. The economic perspective is thus analogous to Putnam's argument: social capital enhances economic productivity without consciously having economic productivity as its primary goal.<sup>49</sup>

Drawing on the working definition of capital set forth in this article, *social capital* is just another asset that is long-lived and can generate a long-lived stream of benefits. Of the three forms of capital considered in this paper, it is the least costly and time-consuming to acquire, and the stream of benefits flowing from it consists of a number of intangible benefits, be it informational benefits or just the small favors and graces extended to those within a social fabric. These benefits can be extremely important. James Coleman provides a compelling example of the importance of social capital in the Jewish diamond merchant community, in which merchants entrust fellow merchants with diamonds worth very large amounts of money.<sup>50</sup> The reason that thievery is non-existent in this community, despite ample opportunity to engage in it, is explained by the social interconnectedness of the merchants. Stealing would result in ostracism from a community and forfeiture of social, family, and religious ties.<sup>51</sup> Social capital thus often plays a vital economic role, lubricating merchantile relations while obviating the need for expensive and perhaps ultimately futile monitoring.<sup>52</sup>

Social capital could play a critical role in motivating poor, resource-based communities to fight regulation. In resource-based communities otherwise lacking in physical or human capital, social capital is a more egalitarian form of capital, requiring little of the financial resources that are necessary and sometimes unavailable to socio-economically disadvantaged groups.<sup>53</sup> Strong social interconnectedness has been observed in a variety of fishing communities.<sup>54</sup> As it happens, fishers are, even among resource industries,

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49 See, e.g., Arrow, *supra*, note 46, at 4.

50 James S. Coleman, *Social Capital in the Creation of Human Capital*, 94 AM. J. OF SOCIOLOGY S95, S98 (1988).

51 *Supra*, note 50, at S99.

52 *Supra*, note 50, at S99.

53 Putnam has written that "historically social capital has been the main weapon of the have-nots, who lacked for other forms of capital." PUTNAM, *supra*, note 48, at 359.

54 James A. Wilson, *Adaptation to Uncertainty and Small Numbers Exchange: The New England Fresh Fish Market*, 11 BELL J. ECON. 491 (1980); James M. Acheson, *The Maine Lobster Market: Between Market and Hierarchy Reviewed*, 1 J. L. ECON. & ORG. 385 (1985); Sean Lauer, *Entrepreneurial*

legend for their resistance to regulation.<sup>55</sup> As in the Jewish diamond broker example, trust and reciprocity, the social capital that is formed from long-running relationships, have served a vital economic purpose for low-profit industries that cannot afford expensive or time-consuming monitoring efforts. Indeed, when social capital is low – when interconnectedness is not present – fishing communities that otherwise resemble other communities with high social capital – function much less efficiently and are much less profitable.<sup>56</sup>

Social capital is still, in a sense, costly to obtain, as it requires time and effort to earn trust and to credibly signal the intent to cooperate.<sup>57</sup> Like physical and human capital, once created by sustained cooperation or assistance, social capital can yield a stream of benefits that becomes extremely valuable and in some cases, economically necessary. Even though social capital is not readily monetizable, it can be even more valuable to its holder than tangible assets like physical capital. Perhaps more significantly, it can be the only form of capital held by some individuals and some groups.

To be sure, most capital contains combinations of all three kinds of capital. Physical capital contains the embedded human capital required to design and build a highly sophisticated and expensive piece of equipment. Social capital is invariably embedded as well, in the form of the informal cooperative arrangements that are needed for a large-scale endeavor to be productive. Physicality is just the most obvious aspect of capital.

## II. How Capital Impedes Reform

Exactly how does the presence of excess capital impede policy reform? This section briefly describes the capital that is embedded in a number of industries that have been belatedly shown to cause a number of environmental problems. This section then sets out a simple model showing

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*Processes in an Emergent Resource Industry: Community Embeddedness in Maine's Sea Urchin Industry*, 70 RURAL SOCIOLOGY 145 (2005).

<sup>55</sup> See, e.g., SUZANNE IUDICELLO ET AL., FISH, MARKETS, AND FISHERMEN: THE ECONOMICS OF OVERFISHING 45-47 (1999); Shi-Ling Hsu, *What IS a Tragedy of the COMMONS? OVERFISHING AND THE CAMPAIGN SPENDING PROBLEM*, 69 Albany L. Rev. 75, 130 (2006).

<sup>56</sup> Sean Lauer, *Relationships in Inshore Fisheries*, 23 SOCIOLOGICAL F. 503 (2008).

<sup>57</sup> See, e.g., Edward L. Glaeser, David Laibson, and Bruce Sacerdote, *An Economic Approach to Social Capital*, 112 ECON. J. F437, F454 (2002).

how relatively small incentives for capital formation might lead to large increases in capital investment, creating a tendency to "super-size" capital.

A. Overcapitalization as a Drag on Environmental Reform

The thesis of this article is that legal rules and institutions have helped create too much capital, which has led to a heightened resistance to legal reform. Legal rules and institutions have over-promoted the formation of capital that is later discovered to cause latent environmental harms. Even after the latent environmental harms come to light, laws have over-protected capital, at the expense of environmental quality. This is at least in part the story of how almost every environmental externality has been allowed to persist longer than a rational society would have allowed. In some way, capital has gotten in the way of solving almost every environmental problem in the history of humankind.

It is important to consider capital in its varied forms, not just the physical capital – the bricks and mortar that are easily priced and monetizable, but the human and social capital that is intertwined with industrial practices and processes. The operation of physical capital to generate wealth requires a tremendous amount of human capital and industry-specific know-how. In addition, any endeavor of any reasonable size requires informal cooperation, and the development of a network of social capital. The importance of such human and social capital is likely to be understated, since their acquisition costs will generally not reflect their intrinsic value. For individuals possessing human capital that would be devalued by changes in industrial practices (such as oilrig or oilfield workers), or social capital that is specific to a small town that is predicated on a specific practice (such as that of a fishing or coal-mining community), their role in an anachronistic industry may be the only realistic source of income or sustenance. If, as is very often the case, these kinds of human or social capital may not be transferred to another setting, the switching costs for these people are essentially infinite. Were the source of income in these industries and communities to dry up, these people would essentially lose everything. That desperation may be a false perception, but for purposes of explaining the level of resistance to reform, it may as well be reality.

When these broader forms of capital are considered, it becomes less of a mystery as to why policy reform can be so politically and legally painful. Cost-benefit analyses do not capture the full array of perceived costs: the losses to human and social capital occurring after environmental regulation (or some other economic change) are highly salient to those possessing it, and far exceed any monetizable amount. And yet, there is no basis for taking such human and capital costs into account, or for compensating the

holders of such capital: there is no inherent societal value of human or social capital if it is specific to an anachronistic industry.

Overcapitalization plays a central role in the greatest environmental problem ever, and the greatest market failure<sup>58</sup> ever: global climate change. Developed economies have developed largely because of capital-intensive energy sectors. Thanks to sprawling energy infrastructures, fossil fuels are efficiently extracted, transported, and burned to generate energy at low prices. The problem is that greenhouse gas emissions from fossil fuel-based economies threaten to irreversibly and catastrophically warm the planet.<sup>59</sup> Coal, the most carbon-intensive of the fossil fuels, continues to play a central role in energy provision. As noted briefly above,<sup>60</sup> strong convincing evidence exists that coal combustion, given its social and environmental costs and its contribution to climate change, is simply no longer worth it.<sup>61</sup> And yet, coal combustion persists. Most energy forecasts project an *increase* in coal production.<sup>62</sup> The world's stock of coal-fired power plants, with a combined value in the trillions of dollars,<sup>63</sup> are not about to be abandoned. And it is not only the existing stock of coal-fired power plants that comprise the sluggish capital, but the human and social capital that is locked into a fossil fuel-centered way of doing things, that may ultimately consign the world population to living on a climate-changed planet.

All this is to say that capital, in all its forms, has played a special role in blocking environmental law and policy reform. Perhaps more than even the

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58 Nicholas Stern, the author of the Stern Review on the Economics of Climate Change, has called climate change the "greatest market failure the world has seen." NICHOLAS STERN, *THE STERN REVIEW ON THE ECONOMICS OF CLIMATE CHANGE* viii (2007), available online at [http://www.hm-treasury.gov.uk/stern\\_review\\_report.htm](http://www.hm-treasury.gov.uk/stern_review_report.htm).

59 For a brief review of the voluminous literature on greenhouse gases and the risks of climate change, *see*, ROBERT HENSON, *A ROUGH GUIDE TO CLIMATE CHANGE* (2d ed. 2010).

60 Introduction, *supra*.

61 Even the most conservative estimates of the costs of climate change, coupled with other externalities, suggest that the benefits of this anachronistic industry are far exceeded by the costs. *See, e.g.*, Muller, et al, *supra*, note 17.

62 U.S. ENERGY INFORMATION ADMINISTRATION, AEO2013 EARLY RELEASE OVERVIEW 15-16 (Table 1) (2013); online: <http://www.eia.gov/forecasts/aeo/er/>.

63 A very rough estimate of the value of the stock of the world's coal-fired power plants can be obtained by multiplying world capacity (IEA World Energy Outlook, *supra* at 543-616, 647-640) by a weighted average of overnight costs, weighted by plant location (International Energy Agency, *Projected Costs of Generating Electricity 2010* 60 (2010). This back-of-the-envelope calculation is \$2.4 trillion USD in 2009.

stickiness of physical capital, environmental policy reform has bumped up against human and social capital that has become specialized to a specific industry or practice. These forms of capital can come to represent the very identity of a firm, person, or group. Destroying that capital can appear to be tantamount to destruction of that firm, person, or group. Resistance to reform will naturally be vigorous.

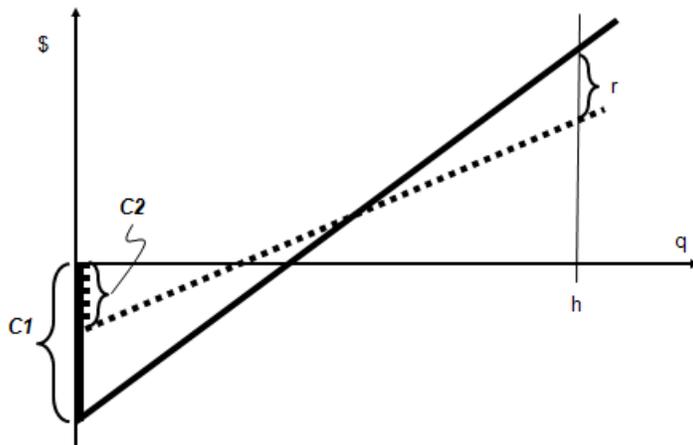
#### B. A Model of How Capital Impedes Reform

To see how this overcapitalization can lead to policy inertia, consider a simple stylized example of two types of investments: a low-capital-cost, low-benefit-stream investment, and a high-capital-cost, high-benefit-stream investment. The goal of any acquisition of any capital is to enjoy a stream of future benefits, but along with a higher stream of future benefits comes the risk that the future benefits may not fully materialize (for example, due to an unfavorable change in the regulatory or economic environment). Absent risk, the long-term value of the high-capital-cost, high-benefit-stream investment is greater. In this simple example, the only reason to choose a low-capital, low-profit strategy over high-capital, high profit strategy is the avoidance of risk. Of course, this abstracts away from many other determinants of capital ownership, like access to capital and discounting, and abstracts away from many other attributes of capital ownership, like market power and signaling benefits or detriments (like prestige or scorn). But heuristically, it is reasonable to work from the simplifying assumptions that the only reason to take on more expensive capital and the attendant risk is to generate a larger stream of benefits.

These two strategies are graphically depicted in Figure 1. Two different firms make a capital investment at an initial investment cost,  $CI$ , for the high-capital, high-profits strategy, and  $C2$  for the low-capital, low profits strategy. The cost of capital instantly drives down firm profitability, but capital generates a revenue stream that increases firm profitability as sales of the produced good generate revenues to pay back the cost of capital. In figure 1, the profitability of the firms, i.e., the *cumulative* sum total of firm revenues and expenses, is graphed as a function of  $q$ , the quantity of sales. This cumulative profit line – the solid line for the high-capital, high-profits strategy – has a steeper slope than the dotted line that for the low-capital, low-profits strategy. Figure 1 represents the simple case in which the price and operating costs are constant for all units sold, so that profitability is linear in  $q$ . In an even simpler case, sales would be uniform over units and also over time, so that the horizontal axis could be time and the payback period represented by the point in time at which the profitability crosses the horizontal axis.

Ultimately, capital generates a cumulative profit. Assuming the expected life of the capital in both cases to be  $h$ , the cost of risk associated with the high-capital, high-profits strategy is  $r$ . This also abstracts away from considerations having to do with discounting.

Figure 1.



*Ex ante*, the cost of risk is simply a premium that is assumed by the firm adopting a high-capital, high-profits strategy. The premium compensates for the risk of a regulatory change that, in this simple case, renders the capital obsolete and valueless. So if a firm is risk-taking, it adopts the high-capital, high-profits strategy because the risk premium is sufficient compensation for the risk. Relatively risk-averse firms will opt for the low-capital, low-profits strategy. In figures 2a and 2b below, a regulatory change that renders the capital obsolete and valueless occurs when the firm has sold  $x$  units. The losses for the high-capital, high-profits strategy and the low-capital, low-profits strategy are shown in figure 2a and 2b below, respectively, as **L1** and **L2**.

Fig. 2a.

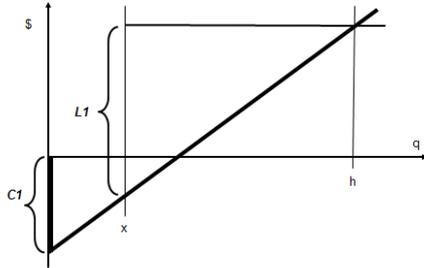
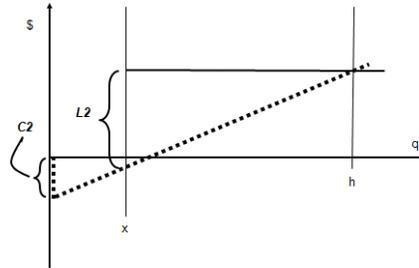


Fig. 2b.



It is thus not the capital itself that industries, firms, and individuals fight vigorously to protect; it is the expected stream of benefits that inspires such vigorous defense. It so happens that most of the time, we should expect that the more expensive the capital, the greater is the stream of benefits. But that would be an imprecise conclusion. Expected benefits could well be capitalized into a valuation of capital, but far from being universally true, there is ample reason to suspect that capital is rarely perfectly priced to reflect the expected stream of benefits.<sup>64</sup> Ultimately, it is the hoped-for stream of benefits that a firm, having acquired capital, will struggle to protect; it will expend any amount up to the value of the hoped-for but lost stream of benefits.

Obviously, the loss suffered by an unfavorable change in the legal or economic environment is greater in the high-capital, high-profits scenario; there is a larger stream of benefits to lose. All other things being equal, as long as the high-capital, high-profits strategy yields higher marginal profits (again, this is assumed, because in this simple model there would otherwise be no reason to expend higher amounts of capital), the loss **L1** will always be greater than the loss **L2**.

What is non-intuitive about the role of capital is the *ex post* amplification of the importance of the initial investment. *Ex ante*, the equilibrium cost of the risk is  $r$ . *Ex post*, however, once the capital is sunk, the stake is not just  $r$ , nor is it just the cost of capital. After the initial investment in capital, the risk of loss is equal to the expected stream of benefits. In order to combat such a loss, the owner of capital will expend any amount of money up to the expected loss (**L1** or **L2**), which could well exceed the cost of the capital (**C1** or **C2**). So the amount of money spent on resisting policy change can be

<sup>64</sup> See, e.g., Franklin M. Fisher, *On the Misuse of the Profits-Sales Ratio*, 18 RAND J. ECON. 384, 392 (1987).

highly sensitive initial decisions on capital investment. Just a subtle nudge, such as that provided by an obscure legal provision, can magnify differences in capital investment, and lead to a very different world in terms of incentives to resist policy change.

Whether a firm chooses the high-capital, high-profits strategy or not thus has profound implications for economic efficiency. Put simply, the greater the value of the capital, the greater the threat of obsolescence for the firm owning the capital, and the greater efforts it will undertake to resist reform. An overcapitalized society will be a society in which there are more efforts to resist reform. Since capital in its various forms regularly experiences obsolescence, a capital-protecting society is a society that is less agile, and less receptive to reform that threatens the value of that capital.

Note that losses *L1* and *L2* are only fully realized if the capital is "stranded," or unsusceptible of redeployment. More generally, the problem of avoiding loss can be considered as a problem with switching costs, and the losses *L1* and *L2* can be more generally considered the net costs of being forced (economically or by regulation) to switch capital to a new use. *L1* and *L2* are thus the lesser of switching costs and the complete economic loss of a stream of benefits.

This theory of capital-protecting offers insight into a further subtlety. When there is human or social capital involved, the monetization of a stream of benefits could appear quite small in comparison with the value of physical capital. But when the stream of benefits generated by that human or social capital is perceived (accurately or not) to be the only possible source of income, the marginal value of the stream of benefits generated by that human or social capital can be extremely high to the capital-holder, perhaps even infinite. Defense of this kind of capital could be very vigorous.

In sum, capital will *always* pose a barrier to policy reform, because policy reform will always take place when some capital assets have some remaining life and have the capacity to generate a prospective stream of benefits. Switching costs are never zero, so redeployment will always be costly. A normal economy will thus always generate some resistance to policy change. But the problem identified in this article is that legal rules have biased capital decisions towards larger capital, larger profits, and concomitantly larger risks of obsolescence. Having sunk a larger investment into capital, owners of that capital will resist policy reform with greater effort. A systemic over-promotion and over-protection of capital is thus creating a greater drag on policy reform than would otherwise be the case.

### III. The Role of Law and Lawmaking in Promoting and Protecting Capital

What exactly is the role of law in this story of policy inertia? The focus of this article is on the role that law and policy play on the *antecedent conditions* that give rise to an overcapitalized economy, thereby generating policy inertia. Law and policy create overcapitalized economies in two ways: (i) laws that over-promote the formation of capital, and (ii) rules over-protecting capital from changes in its legal or economic environment.

Laws that promote the formation of capital create policy inertia indirectly because they lower the cost of capital and induce larger investments than would otherwise occur. Capital-friendly rules thus enlarge capital stock, and therefore increase the incentives to resist reform. In short, capital-friendly rules impede policy reform by increasing the private costs of policy reform.

The latter mechanism, rules that protect capital, prolong the life of capital even when environmental harms outweigh economic benefits. For example, a rule grandfathering existing capital into older, less stringent regulatory schemes is one example.<sup>65</sup> Note that this latter mechanism has a doubly pernicious effect: it entrenches existing capital regardless of its inherent social value, and it also produces an antecedent effect of providing assurances to new capital investors that their capital will also be similarly protected from unfavorable changes in legal rules. Investors will over-invest knowing that legal leniencies will at least partially insure them against obsolescence.

It is worth bearing in mind that the incentives for capital formation can be quite small. All that is needed is something to change the decision environment, not finance the undertaking. A small subsidy can induce the formation of capital by just tilting a close decision. It can also induce an upgrade in capital in a situation where a more modest investment would otherwise be privately optimal.

This article will discuss five ways in which law and policy over-promote the formation of capital, and over-protect obsolescent capital: (1) tax benefits for energy industries; (2) tax benefits for mining industries; (3) electric utility regulation; (4) grandfathering; and (5) regulatory takings jurisprudence. This section will also discuss the special political application of this theory to human and social capital.

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<sup>65</sup> This is discussed in section II.C. below, *infra*.

A. Tax Benefits for Energy Industries

Clearly, federal and state governments have subsidized the formation of energy capital through tax benefits for a long time (by some estimates, a century).<sup>66</sup> Equally clearly, subsidies have resulted in the formation of excess energy capital.<sup>67</sup> But defining a subsidy is tricky, especially in the energy industry, in which there are both economies and diseconomies of scale, and sometimes the need for a regulated monopoly. Is the regulation and price-setting of electricity an energy subsidy? Also, certain tax advantages inure to the benefit of many industries, of which energy is just one; would that be an energy subsidy? The definitional problems abound.

This article will focus on subsidies that: (i) involve direct payments from the federal government to an energy firm, (ii) reduce or defer the tax liability for an energy firm but do not apply to non-energy firms, or (iii) provide some indirect but clearly financial benefit, such as a loan guarantee. These are the types of subsidies that are most likely to lower the cost of capital and induce excess formation of capital.

Some subsidies may promote the formation of capital that confers positive externalities. For example, subsidizing the construction of electricity transmission lines is more akin to the provision of a public good<sup>68</sup> that might warrant subsidization. In such cases, it might be hard to say if the capital being formed is "excess," as the public good nature of the problem suggests that there would typically be a shortage of capital.<sup>69</sup> Those

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66 The expensing of intangible drilling and exploration costs for independent oil and gas producers has been allowed since 1913. 26 U.S.C. § 263(c). U.S. Congressional Research Service, Oil and Gas Natural Gas Industry Tax Issues in the FY2012 Budget Proposal 3 (March 2, 2012) (hereinafter "CRS Report"); online: <http://budget.house.gov/uploadedfiles/crsr42374.pdf>.

67 See James C. Cox & Arthur W. Wright, *The Cost-effectiveness of Federal Tax Subsidies for Petroleum Reserves: Some Empirical Results and Their Implications*, in STUDIES IN ENERGY TAX POLICY 177, 188-89 (Gerard Brannon ed., 1975) (finding that special tax provisions induced the petroleum industry to maintain larger investments in proved reserves); Walter J. Mead, *The Performance of Government in Energy Regulations*, 69 AM. ECON. REV. 352, 352 (1979) ("These tax subsidies [percentage depletion allowance and expensing of intangible drilling costs] led to increased capital flows into exploration.").

68 TOM TIETENBERG, ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS 31 (9th ed. 2012).

69 Discussed in section IV., *infra*.

## LATENT EXTERNALITIES

subsidies are generally not targeted in this article, and in fact are considered below as the kind of subsidy that might be socially beneficial.<sup>70</sup>

What is very much the target of this article is the kind of energy subsidy that seeks to simply lower the price of energy. While low energy prices do stimulate economic development, there is no reason to believe that energy would be undersupplied absent a subsidy. Energy is not a public good.<sup>71</sup>

What then, are the subsidies that have led to the formation of excess energy capital? The coal industry has long enjoyed a privileged place in American energy policy.<sup>72</sup> Most coal has been combusted for electricity generation which, because it has predominantly been a regulated utility, has enjoyed a special set of legal protections that have resulted in a vastly overcapitalized industry.<sup>73</sup> But mining coal itself is also a privileged activity. Coal mining rights are often owned and leased, and disposition of the coal typically results in a royalty payment. For owners receiving royalty payments who are individuals, the royalty payments can be taxed at the lower capital gains tax rate.<sup>74</sup> While ordinary lease payments (such as for residential or commercial property) must be taxed as income, coal mining rights are considered a capital asset that can be taxed at the lower rate. This brings marginal coal mines into production, and expands the attendant infrastructure to extract and transport the coal.

The other fossil fuels, oil and natural gas, have also been heavily subsidized. The Internal Revenue Code has long granted preferential tax treatment to entities undertaking capital projects for the exploration and extraction of oil and natural gas. Independent oil and gas producers – generally speaking

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<sup>70</sup> Discussed in section IV., *infra*.

<sup>71</sup> Note that this is *not* the same thing as making the argument that failing to internalize environmental externalities is tantamount to a subsidy; the policy remedy of an environmental externality is the imposition of a Pigouvian tax, not the withdrawal of a subsidy. The thrust of this article is that certain legal institutions have created antecedent conditions that over-promote capital and once formed, over-protect. It is different to say that an *omission* such as the failure to impose a Pigouvian tax is part of that legal infatuation with capital.

<sup>72</sup> FREESE, *supra*, note 14 at 130 ("In the United States, ... still in its formative stages, coal would have an even greater impact on the political power structure of the nation.").

<sup>73</sup> Discussed in subsection B. below.

<sup>74</sup> 26 U.S.C. §631(c). Section 631 also applies to timber and iron ore.

small, non-integrated oil and gas producers<sup>75</sup> – are permitted to deduct from income taxes a "percentage depletion" of their oil or gas deposit basis rather than a cost depletion method of accounting. That is, rather than try to estimate the value of their deposit and deduct from their annual income taxes, they may simply deduct fifteen percent of their gross income as a generous proxy for the depreciated value of their oil and gas deposits.<sup>76</sup> So long as the expected life of the oil and gas well is greater than 6.67 years ( $100 \div 15$ ), this represents an accelerated depreciation of their asset, and a financial benefit in the form of a deferred tax liability. In addition, independent producers are permitted to take a more generous deduction for "intangible drilling costs," defined as a cost incidental to drilling that has no salvage value and is "incidental to and necessary for the drilling of wells and the preparation of wells for the production of oil and gas." These expenses expressly include "wages, fuel, repairs, hauling, supplies, etc.," that are required for the site preparation and drilling of wells.<sup>77</sup> Seventy percent of intangible drilling costs are allowed to be deducted from income in the year in which they are incurred, and the remaining 30% percent depreciated over a five-year period.<sup>78</sup> This, too, represents a significant benefit in the form of a deferred tax liability. Finally, geological and geophysical exploration activities may be depreciated over an accelerated two-year schedule, again producing a front end-loaded depreciation schedule and an effective tax liability deferral. These three subsidies are, according to a 2011 report by the U.S. Energy Information Administration,<sup>79</sup> the three most valuable subsidies for the oil and gas industry, estimated by the EIA to be \$980 million, \$400 million and \$150 million, respectively, for 2010, for a total of about \$1.53 billion.<sup>80</sup> Over

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75 The Internal revenue code defines oil and gas producers as independent if, among other requirements, they have no more than \$5 million in gross receipts in a given year, 26 U.S.C. §613A(d)(2).

76 CRS Report, *supra*, note 66, at 3.

77 26 U.S.C. §263(c).

78 *Id.*

79 U.S. DEPARTMENT OF ENERGY, ENERGY INFORMATION ADMINISTRATION, DIRECT FINANCIAL INTERVENTIONS AND SUBSIDIES IN ENERGY IN FISCAL YEAR 2010 18 (Table 6) (July 2011); online: <http://www.eia.gov/analysis/requests/subsidy/pdf/subsidy.pdf>.

80 It is well worth noting that estimates of the value of these subsidies, as well as others, vary greatly. In recent budget negotiations, President Obama proposed a budget for 2013 that would have eliminated the percentage depletion allowance and the expensing of intangible drilling costs, and lengthened the two-year amortization period for geological and geophysical activities. The Congressional Research Service estimated the cost savings of these changes to be

## LATENT EXTERNALITIES

time, the subsidies appear even more generous. A literature-based study done by a venture capital firm specializing in energy investments estimates that from 1918 to 2009, oil and gas firms have received \$447 billion in subsidies, measured in 2010 dollars.<sup>81</sup>

It is difficult to even guess at the effect of this infusion of money on capital formation in the energy industry, and on policy resistance. Studies have clearly shown a higher level of investment induced by these tax benefits.<sup>82</sup> It is another matter to determine exactly how much these subsidies have bloated the capital stock. But \$447 billion over 91 years – an average of \$4.9 billion per year – is a lot of money to inject into even the mammoth oil and gas industries.

It is worth remembering two things. First, because a subsidy need only subtly nudge capital decisions, the capital-bloating effect of a subsidy could vastly exceed the cost of the subsidy. So \$4.9 billion could well have generated excess capital in an amount much greater than \$4.9 billion. Second, the subsidy itself is a source of funding for resistance to policy reform. If even a small fraction of \$4.9 billion were spent on litigation and lobbying activities, the effect on public policy would have been profound.

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\$13.9 billion, \$11.5 billion, and \$1.4 billion, all over ten years. CRS Report, *supra*, note 66, at 3.

81 NANCY PFUND AND BEN HEALEY, WHAT WOULD JEFFERSON DO? THE HISTORICAL ROLE OF FEDERAL SUBSIDIES IN SHAPING AMERICA'S ENERGY FUTURE 29 (September 2011); online: [http://i.bnet.com/blogs/dbl\\_energy\\_subsidies\\_paper.pdf](http://i.bnet.com/blogs/dbl_energy_subsidies_paper.pdf).

82 Cox & Wright, *supra*, note 67, at 188-89; Mead, *supra*, note 67, at 352. According to the trade group Texas Alliance of Energy Producers, President Obama's similar proposal for fiscal year 2011 to eliminate of these four tax benefits (and some other, much less expensive ones) would have reduced oil and gas investment by \$26 billion over ten years. The Texas Alliance of Energy Producers, *Oil & Gas Provisions in President Obama's Proposed 2011 Budget* (no date) online: [http://www.texasalliance.org/admin/assets/Tax\\_provisions\\_in\\_Obama\\_budget.pdf](http://www.texasalliance.org/admin/assets/Tax_provisions_in_Obama_budget.pdf) (last visited December 23, 2012). But there is no study or data to support these estimates. Also, given the similarity of this figure with the other estimates (that of the CRS estimates for the President's 2013 proposal, *supra*, note 66, and the EIA estimates of the cost for fiscal years 2007 and 2010, *supra*, note ), these estimates are more likely just the group's own estimates of the value of the withdrawn subsidies, not the absolute amount of withdrawn capital investments.

President Obama has repeatedly proposed to phase out or eliminate subsidies for oil and gas companies.<sup>83</sup> To the extent that these subsidies stimulate the formation of capital, these are good steps. There is in most cases nothing remotely resembling a public good in the oil and gas industry warranting subsidization. But the mistake that the Obama Administration makes – like all preceding modern administrations – is to try to right a wrong by subsidizing competing, cleaner energy sources such as renewable energy. Because renewable energy does not impose the negative environmental externalities imposed by the extraction and combustion of fossil fuels, it would seem to stand to reason that it is worth subsidizing their production so as to place fossil fuels and renewable sources on a level playing field.

With an exception discussed below,<sup>84</sup> this is mistaken thinking. A subsidy lowers the effective cost of capital, and promotes the formation of new capital. The problem with promoting capital investment in non-fossil fuel energy sources is that it fails to learn from our past mistakes in promoting fossil fuel energy sources. How do we know this is the "right" energy technology? What will happen if information emerges pointing to alternative energy sources that are even cleaner? Promoting the formation of capital in specific renewable energy technologies runs the risk of locking in these technologies for longer than would be optimal. Future policy efforts at reform to usher in newer and even better technologies will be met with resistance by the owners of this capital.

Energy policies in pursuit of cleaner alternatives to fossil fuel combustion are pursuing this misguided course. Federal energy subsidies have increased since 2007, and although they seek to correct an historical imbalance between fossil fuel and renewable energy technologies,<sup>85</sup> it repeats the historical mistake of trying to accomplish an objective by exhorting the

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83 Executive Office of the President of the United States, Office of Management and Budget, Budget of the United States, Fiscal Year 2011 161-162 (2010); online: <http://www.gpo.gov/fdsys/pkg/BUDGET-2011-BUD/pdf/BUDGET-2011-BUD.pdf>; Executive Office of the President of the United States, Office of Management and Budget, Budget of the United States, Fiscal Year 2012 185-186 (February 14, 2011); online: <http://www.whitehouse.gov/sites/default/files/omb/budget/fy2012/assets/budget.pdf>; Executive Office of the President of the United States, Office of Management and Budget, Budget of the United States, Fiscal Year 2013 221-222 (2012); online: <http://www.whitehouse.gov/sites/default/files/omb/budget/fy2013/assets/budget.pdf>

84 Discussed in section IV.B., *infra*.

85 PFUND & HEALEY, *supra*, note 81.

## LATENT EXTERNALITIES

formation of capital. Federal energy subsidies more than doubled from 2007 to 2010, from almost \$18 billion to more than \$37 billion, and nearly all of that increase has been due to subsidies for non-fossil energy sources.<sup>86</sup>

In some aspects, new subsidies for renewable energy providers are even more capital-intensive than those for oil and gas. Producers of electricity from renewable energy sources have long benefitted from a production tax credit, a unitary subsidy for each kilowatt-hour of electricity produced using a "qualified" production method.<sup>87</sup> Section 1102 of the American Recovery and Reinvestment Act of 2009<sup>88</sup> (ARRA) sweetens things, allowing renewable energy providers to elect to take an Investment Tax Credit instead of the production tax credit, thereby front-loading the subsidy and immediately reducing the cost of capital, rather than allowing for a potentially larger stream of subsidy payments. But even better still, for certain renewable energy providers,<sup>89</sup> section 1603 of ARRA offers a cash grant of ten or thirty percent in lieu of the investment tax credit and the production tax credit,<sup>90</sup> the advantage over a tax credit being that there need not be any income against which to offset a tax credit. The "Section 1603 program" has been enormously popular, expenditures for the grant totaling \$4.2 billion in 2010,<sup>91</sup> and far surpassing the costs of the production tax credit and the investment tax credit, which were \$1.5 billion and \$130 million, respectively, in 2010.<sup>92</sup> It was even an explicit goal of ARRA to inject money into the economy to assist in the economic recovery.<sup>93</sup>

In addition, the Department of Energy operates several loan guarantee programs for qualifying projects or firms. Section 406 of ARRA, amending

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86 U.S. DEPARTMENT OF ENERGY, ENERGY INFORMATION ADMINISTRATION, DIRECT FINANCIAL INTERVENTIONS AND SUBSIDIES IN ENERGY IN FISCAL YEAR 2010 xi (Table 6) (July 2011); online: <http://www.eia.gov/analysis/requests/subsidy/pdf/subsidy.pdf> (hereinafter "EIA Report").

87 26 U.S.C. §45.

88 Pub. L. No. 111-5, 123 Stat. 115 (2009) (Section 1603) as amended by Section 707 of the Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010, Pub. L. No. 111-312.

89 Solar, fuel cells, geothermal, wind, hydro, biomass, marine and hydrokinetic energy sources qualify. ARRA §1603(d)(1), citing 26 U.S.C. §45(d), subsections (1), (2), (3), (4), (6), (7), (9) & (11).

90 *Supra*, note 88; 26 U.S.C. §48(d).

91 EIA Report, *supra*, note 86, at 30-31.

92 EIA Report, *supra*, note 86, at 13 (Table 3).

93 EIA Report, *supra*, note 86, at xi, at 5.

Title XVII of the Energy Policy Act of 2005,<sup>94</sup> provides for loan guarantees for "renewable energy systems," "electric power transmission systems," and "leading-edge biofuel projects."<sup>95</sup> By the end of 2010, DOE had issued over \$25 billion in loan guarantees.<sup>96</sup> It was under this program that DOE issued a loan guarantee to the failed solar energy company, Solyndra, which brought controversy to the program.<sup>97</sup> Also controversially, DOE is authorized to guarantee 100% of a loan, not a more traditional fraction, like eighty percent.<sup>98</sup> Some funding was also issued to aid in the construction of nuclear power plants.<sup>99</sup> Overall, spending on renewable energy technologies was much greater than spending on fossil fuel technologies: more than \$14 billion to just over \$4 billion.<sup>100</sup>

The goal of trying to rapidly ramp up renewable energy production is certainly laudable, especially in the face of an inability to pass comprehensive climate legislation that might achieve an energy transition in a more holistic way. It is still troubling, however, to consider how much capital is being formed, with relatively little known about the relative merits of wind energy as opposed to other technologies that may emerge in the next several years. From 2000 to 2010, net generation of electricity from wind power rose from six billion kilowatt-hours to 95 billion,<sup>101</sup> and net summer capacity for wind energy grew from just about eight gigawatts in 2005 to over 39 gigawatts in 2010.<sup>102</sup> This is troubling because the technology of electricity production is constantly evolving. Only recently did Congress suddenly notice the potential of hydrokinetic energy, the use of wave action to generate electricity. Only recently has low-tech solar thermal energy gained attention, as it has become competitive much more

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94 42 U.S.C. §16511 et seq (2005).

95 Publ. L. 111-5, 123 Stat. 145 (2009).

96 EIA Report, *supra*, note 86, at 59.

97 *See, e.g.*, Ashley Southall, House Passes Solyndra Act Aimed at Obama, N.Y. Times, The Caucus: the Political and Government Blog of the New York Times, September 14, 2012; online: <http://thecaucus.blogs.nytimes.com/2012/09/14/house-passes-solyndra-act-aimed-at-obama/?ref=solyndra>.

98 EIA Report, *supra*, note 86, at 59.

99 EIA Report, *supra*, note 86, at 64.

100 EIA Report, *supra*, note 86, at xiii (Table ES2).

101 EIA Report, *supra*, note 86, at xx (Table ES-5).

102 U.S. DEPARTMENT OF ENERGY, ENERGY INFORMATION ADMINISTRATION, ELECTRIC POWER ANNUAL 2010 (Table 1.1B) (2011); online: <http://www.eia.gov/electricity/annual/html/table1.1b.cfm>.

## LATENT EXTERNALITIES

quickly than the previously favored solar technology, photovoltaics.<sup>103</sup> If a new and better renewable energy technology is discovered, what will be the policy response of wind energy developers that have invested billions of dollars?

As I have argued elsewhere, the correct response to the environmental externality of emissions from fossil fuel-fired sources is *not* to try and subsidize all that is not fossil fuels.<sup>104</sup> If there is a negative environmental externality, the right approach is to tax the negative externality, not to subsidize everything else. It seems politically more palatable to subsidize "good" industries than it is to tax "bad" industries,<sup>105</sup> but the politically expedient approach is less efficient.<sup>106</sup> In the context of energy policy, a much more effective and efficient policy tool than subsidization is a carbon tax.<sup>107</sup> Among other problems with the pushing-on-a-string effectiveness of trying to prop up all that is putatively good,<sup>108</sup> subsidizing "good" industries promotes the excessive formation of capital. A tax on a negative environmental externality is capital neutral.<sup>109</sup> Capital formed in one industry (e.g., wind energy) because negative externalities are taxed in another industry (coal, oil, or natural gas) will not be as likely to become obsolete, because it is responding to a technology-neutral price signal, not a political judgment.

### B. Tax Benefits for Mining Industries

There is one industry that may benefit from even greater taxpayer generosity than the energy sector: the hardrock mining industry. Few industries create as many or as severe environmental externalities as the mining industry.<sup>110</sup> But apparently following in the same industrial-development, low-commodity-price rationales that animate energy subsidies, a variety of favorable tax provisions facilitate the formation of mining capital. Exploration and development expenses for mining

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103 SHI-LING HSU, THE CASE FOR A CARBON TAX: GETTING PAST OUR POLITICAL HANGUPS TO EFFECTIVE CLIMATE POLICY 43 (2011).

104 HSU, *supra*, note 103, at 34-37.

105 HSU, *supra*, note 103, at 118-24.

106 HSU, *supra*, note 103, at 53-59.

107 HSU, *supra*, note 103, at 34-37.

108 HSU, *supra*, note 103, at 34-37.

109 HSU, *supra*, note 103, at 41-45.

110 United Nations Environment Program, Principles for Responsible Investment, Universal Ownership: Why Environmental Externalities Matter to Institutional Investors 27 (Chart 3) (2011); online: [http://www.unpri.org/files/uop\\_long\\_report.pdf](http://www.unpri.org/files/uop_long_report.pdf).

companies, unlike for oil and gas companies, are deductible *in full* in the year those expenses are incurred.<sup>111</sup> The deduction is required to be recaptured when the mine goes into production, but many miners are able to avoid this taxable event by avoiding "production" status.<sup>112</sup>

In Canada, where mining is a centrally important industry,<sup>113</sup> small, start-up mining companies, known as "juniors," can pass through capital losses – losses that cannot be deducted from their income because juniors have no income – up to acquiring companies.<sup>114</sup> The advantage of having this benefit of "flow-through" shares is that a tax deduction is essentially sold from an entity that has no income against which to deduct expenses, to a larger entity that does. Thus, the tax benefit is commodified and made into a valuable asset, creating a premium for shares of juniors and stripping away significant risk in an inherently risky business. From 1987 to 1991, \$2.5 billion (Cdn) of flow-through shares were exchanged, 60% of the funding for mining exploration over that period.<sup>115</sup> Empirical research suggests that this has led to capital overinvestment in the mining industry, and below-market returns to mining capital.<sup>116</sup> It was the stated policy of the Canadian government that the flow-through share device should promote equity investments in mining and petroleum companies in Canada, and that it should provide financing assistance to junior, non-taxpaying, companies.<sup>117</sup> It has apparently succeeded in this respect.<sup>118</sup>

The extraction of valuable deposits have obviously been vital in developing the economies of wealthy countries. These sectors which are particularly capital-intensive and particularly foundational, in that their abundance seems to be a predicate to economic growth, so perhaps they are particularly tempting targets for subsidization. But this is precisely the superficial and specious growth paradigm that retards policy reform. It is unnecessary, and

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111 26 U.S.C. §617(a)(1).

112 U.S. Department of the Treasury, Internal Revenue Service, *Market Segmentation Specialization Program: Placer Mining Industry*, Training 3147-121 (7-99) 1-1 (1999); online: <http://www.irs.gov/pub/irs-mssp/placer.pdf>

113 Mining and oil and gas extraction together represented 5% of the Canadian economy, and 15% of the Canadian goods-producing economy in 2002. Industry Canada, *Gross Domestic Product (GDP) By Industrial Sector, 2002-2011* (2012); online: [http://www.ic.gc.ca/eic/site/cis-sic.nsf/eng/h\\_00013.html#v1a2b](http://www.ic.gc.ca/eic/site/cis-sic.nsf/eng/h_00013.html#v1a2b).

114 Income Tax Act – R.S.C., 1985, c.1(5<sup>th</sup> Supp.) (Section 40 (2)b)

115 Gordon Lenjosek, *A Canadian Tax Incentive for Equity Investments in Mining*, 79 NEW DIRECTIONS FOR EVALUATION 117, 120 (1998).

116 *Supra*, note 115, at 127.

117 *Supra*, note 115, at 119.

118 *Supra*, note 115, at 125.

indeed potentially very harmful, for government policy to actively stimulate economic growth by promoting the formation of capital. The energy and hardrock mining industries stand as prominent examples of this bias.

### C. Electric Utility Regulation

The law is perhaps no more obsessed with capital than it is in the area of regulated electric utilities. Regulated electric utilities are only permitted by their regulators to charge ratepayers in accordance with the general formula

$$R = O + B \bullet r$$

where  $R$  is the total allowed revenues (to be divided up among ratepayers),  $O$  is the allowed operating expenses,  $B$  is the company's "rate base," all those capital assets from which the company is permitted to earn a return, and  $r$  is the permitted rate of return.<sup>119</sup> Given this regulatory structure, it is in the company's interest to acquire more capital, and expand the rate base as much as possible in order to maximize their permitted revenues. This bias is commonly known as the "Averch-Johnson effect."<sup>120</sup> Although additions to the company's rate base must be "prudently incurred,"<sup>121</sup> and must be "used and useful,"<sup>122</sup> the reality is that the company often has the upper hand in a ratemaking setting in which it seeks to justify its expenditures to a regulator.<sup>123</sup> Empirical evidence for the Averch-Johnson effect is not unambiguous, but generally supportive.<sup>124</sup>

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119 See, e.g., MARLA MANSFIELD, *CASES AND MATERIALS ON RESOURCES, ENERGY, AND ENVIRONMENTAL LAW* 129 (2001); FRED BOSSELMAN, JIM ROSSI & JACQUELINE LANG WEAVER, *ENERGY, ECONOMICS, AND THE ENVIRONMENT* at 507 (2000).

120 Harvey Averch & Leland L. Johnson, *Behavior of the Firm under Regulatory Constraint*, 52 AM. ECON. REV. 1053 (1962).

121 *Duquesne Light Co. v Barasch*, 488 U.S. 299, 309 (1989) (citing *Missouri ex rel. Southwestern Bell Telephone Co. v. Public Serv. Comm'n*, 262 U.S. 276, 291 (1923) (Brandeis, J. dissenting); *Pennsylvania Public Utility Commission v. Philadelphia Electric Co.*, 31 P.U.R.4<sup>th</sup> 15, 15 (Pa. PUC 1980); *FPC v. Hope Natural Gas Co.*, 320 U.S. 591, 600 (1944); Richard A. Posner, *Natural Monopoly and Its Regulation*, 21 STAN. L. REV. 26 (1969).

122 *Duquesne Light Co. v Barasch*, 488 U.S. 299, 302 (1989).

123 For a discussion of the administrative law surrounding ratemaking cases, see, Jacqueline Lang Weaver, *Can Energy Markets be Trusted? The Effect of The Rise and Fall of Enron on Energy Markets*, 4 HOUSTON BUS. & TAX L.J. 1 (2004); Jim Rossi, *The Political Economy of Energy and its Implications for Climate Change Legislation*, 84 TUL. L. REV. 379 (2009). In *In Re Limerick Nuclear Generating Station*, Docket No. I-80100341, 48 P.U.R. 4th 190. (Pa P.U.C. May

Courts and commissions hearing ratemaking cases do not, however, seem overly concerned about the Averch-Johnson effect. In *Limerick Nuclear Generating Station*,<sup>125</sup> the Pennsylvania Public Utility Commission addressed the question of whether a project may be included in the utility's rate base if the project was prudent at the time of commencement but had subsequently become unnecessary. The opinion, one of only a few that actually considered and discussed the Averch-Johnson effect, minimized its import.<sup>126</sup> The Commission's glib dismissal of the Averch-Johnson effect reveals the bias of ratemaking bodies:

We could better spend our time focusing on whether undue and unnecessary financial constraints are leading us toward a future of insufficient electricity supply and the attendant problems of unnecessarily high electricity prices, unnecessarily high oil consumption, and reduced economic growth. These questions transcend the close-in arguments on CWIP that turn on relatively technical points of consumer discount rates and impacts on cost of capital.<sup>127</sup>

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7,1982), The Pennsylvania Utilities Commission, in evaluating expert testimony on a variety of technical and economic matters, wrote:

"In performing our analysis, we are cognizant of the fact that many of the calculations and figures presented in the context of this proceeding are somewhat speculative. Although no one can perfectly see the future, we are convinced that those estimates represent more than educated guesswork on the part of the witnesses." Docket No. I-80100341, 48 P.U.R. 4th 190. at 3 (Pa P.U.C. May 7,1982)

124 See, e.g., Leon Courville, *Regulation and Efficiency in the Electric Utility Industry*, 5 BELL J. ECON. & MGMT. SCI. 53 (1974); H. Craig Peterson, *An Empirical Test of Regulatory Effects*, 6 BELL J. ECON. & MGMT. SCI. 111 (1975); Robert M. Spann, *Rate of Return Regulation and Efficiency in Production: An Empirical Test of the Averch-Johnson Thesis*, 5 BELL J. ECON. & MGMT. SCI. 38 (1974).

125 Docket No. I-80100341, 48 P.U.R. 4th 190. (Pa P.U.C. May 7,1982)

126 Docket No. I-80100341, 48 P.U.R. 4th 190. at 211 (Pa P.U.C. May 7,1982) ("Averch-Johnson phenomenon. This concept, developed in the early 1960s, maintains that the utilities will invariably seek to overbuild their systems. The financial disincentive of not allowing CWIP in the rate base is seen as counteracting this tendency... The Averch-Johnson phenomenon is no longer applicable. Even if it did apply in the early 1960s, there is little current credibility to the A-J phenomenon given the current depressed financial condition of the industry.").

127 Docket No. I-80100341, 48 P.U.R. 4th 190. at 212 (Pa P.U.C. May 7,1982)

This treatment seems to acknowledge that the Averch-Johnson effect is a valid theoretical consideration, but not of any practical importance, at least relative to other considerations. That is regrettable, and highlights how disinclined policymakers and lawmakers are to critically consider the true usefulness of hard and familiar capital. Utility commissions, it would seem, are still more concerned with low electricity prices, and willing to allow the construction of more capital to ensure them.

Electric utility regulation also presents the most compelling illustration of how an industry will fight to maintain a privileged position: rent-preserving through resisting policy reform. The catch-phrase "stranded costs" was born in the wake of widespread state efforts to deregulate electricity generation, and liberalize energy markets. Liberalization means loss of monopoly power, and incumbent electricity generation firms in states trending towards deregulation complained loudly about the costs of power plants that had not yet been recouped from ratepayers.<sup>128</sup> Estimates of the amount of money believed to be at stake in the mid-1990s, the height of deregulation speculation, ranged from \$34 billion to \$210 billion.<sup>129</sup> As explained in this article,<sup>130</sup> the expected stream of benefits could well be greater than the value of the capital stock. The specter of deregulation, which would have disadvantaged incumbent electricity generators, was enough for the industry to embark upon a massive campaign for compensation.<sup>131</sup>

The campaigns surrounding electricity deregulation are complicated, because electricity deregulation itself is complicated. States have traditionally regulated vertically-integrated utilities, and as such, have had primary jurisdiction over electricity generation, transmission, distribution, and marketing. However, not only does the Federal Energy Regulatory Commission (FERC) regulate the interstate transmission of electricity, but federal government has from time to time played a prominent role in setting electricity policy, such as when Congress passed the 1978 Public Utility Regulatory Policies Act<sup>132</sup> (requiring utilities to buy power from

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128 Timothy J. Brennan and James Boyd, *Stranded Costs, Takings, and the Law and Economics of Implicit Contracts*, 11 J. REG. ECON. 41, 42 (1997).

129 Eric Hirst and Lester Baxter, *How Stranded Will Electric Utilities Be?* Publ. Util. Fortnightly, Feb. 15, 1995.

130 See, note 136 and text accompanying, *infra*.

131 Reed W. Cearley & Daniel H. Cole, *Stranded Benefits Versus Stranded Costs in Utility Deregulation*, in 7 THE ECONOMICS OF LEGAL RELATIONSHIPS: THE END OF A NATURAL MONOPOLY: DEREGULATION AND COMPETITION IN THE ELECTRIC POWER INDUSTRY 169 (Peter Z. Grossman & Daniel H. Cole eds., 2003).

132 Publ. L. 95-917, 92 Stat. 3117 (Nov. 9, 1978).

cogeneration sources and from renewable energy sources) and the 1992 Energy Policy Act<sup>133</sup> (which required FERC to order the opening of interstate transmission lines to independent generators), and when FERC actually issued the order to unbundle electricity services<sup>134</sup> and open up interstate transmission lines, under Order 888<sup>135</sup> (which also mandated other things of utilities and transmission owners). Lobbying and lawsuits thus took place on both the state and federal levels.

The unusual characteristic of the electricity deregulation debate was that almost all of the parties, from integrated electric utilities to consumer groups to rural electric cooperatives, agreed: electricity deregulation could work, if done properly (their way). The disagreement was which path would be taken. Electric utilities spent \$5.4 million in 1992 in campaign contributions, which increased to \$9.5 million in 1996.<sup>136</sup> In total, interest groups self-reported (believed to be conservative) a total of over \$50 million in contributions. The end result is a mixed bag: fifteen states have either fully deregulated or actively regulating their electricity markets, and seven have suspended their deregulation plans,<sup>137</sup> including California, which suffered the most humiliating failures of deregulation.<sup>138</sup> The remaining states are not in the process of deregulating electricity at all.

Granted, electricity deregulation is complicated business, challenging the capacity of elected legislatures to comprehend. But given the consensus among interest parties that electricity deregulation is a good thing (as long as they get their way), the stalled nature of electricity deregulation serves as

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133 Publ. L. 109-58, 119 Stat. 594 (Aug. 8, 2005).

134 "Unbundling" means to break up the traditionally vertically integrated electric utilities typical of the regulated monopoly regime. See, e.g. Paul L. Joskow, *California's Electricity Crisis*, National Bureau of Economic Research Working Paper 8442 5 (2001).

135 Order 888, FERC Stats. & Regs. ¶31,036 (1997).

136 Center for Responsive Politics, *Electricity Deregulation* (no date); online: <http://www.opensecrets.org/news/issues/electricity/index.php>.

137 U.S. Department of Energy, Energy Information Administration, *Status of Electricity Restructuring by State* (September, 2010), online: [http://www.eia.gov/cneaf/electricity/page/restructuring/restructure\\_elect.html](http://www.eia.gov/cneaf/electricity/page/restructuring/restructure_elect.html).

138 California electricity consumers suffered high prices and brownouts when electricity suppliers accumulated market power through failures of the deregulation plan, and chose to withhold power in times of electricity shortages. To add to the humiliation, California's See, e.g. Peter Navarro, *On the Political Economy of Electricity Deregulation – California Style*, *The Electricity Journal*, March 2004, at 47 (2004); Paul L. Joskow, *California's Electricity Crisis*, National Bureau of Economic Research Working Paper 8442 (2001), online: <http://www.nber.org/papers/w8442>.

a testament to the power of incumbency. If there is any doubt as to the power of the electricity generation industry to get its way, more evidence can be found in the American Clean Energy and Security Act of 2009,<sup>139</sup> also known as Waxman-Markey after its House sponsors. Waxman-Markey, which passed the U.S. House of Representatives in 2009, instituted a greenhouse gas cap-and-trade program allocated permits to emit greenhouse gases, at least initially, by simply writing the allocations into the bill. The largest recipient of freely allocated emissions permits? Electric utilities would receive 35% of the \$378 billion worth of freely allocated emissions permits,<sup>140</sup> or over \$100 billion of allowances. It was no surprise that the bill had the support of the Edison Electric Institute, the trade association for electric utilities, since it was deeply involved in writing it.<sup>141</sup>

#### D. Grandfathering

Grandfathering, or more generally "transition relief," is a common practice in lawmaking, especially in environmental lawmaking.<sup>142</sup> Because environmental regulation can severely affect the value of capital, environmental laws have often exempted existing capital from new laws or

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139 American Clean Energy and Security Act of 2009, H.R. 2454 (June 26, 2009).

140 American Clean Energy and Security Act of 2009, *supra*, note 139, §§ 782-795.

141 EEI president Thomas Kuhn also made a number of post-passage efforts to support a Senate bill that would be compatible with the Waxman-Markey bill he helped craft. John M. Broder, *Senate Gets a Climate and Energy Bill, Modified by a Gulf Spill That Still Grows*, N.Y. TIMES, May 12, 2010, at A18 ("The leader of the main utility industry trade group, Thomas R. Kuhn of the Edison Electric Institute, stood with Mr. Kerry and Mr. Lieberman on Wednesday and endorsed their bill.").

142 Jonathan R. Nash and Richard L. Revesz. *Grandfathering and Environmental Regulation: the Law and Economics of New Source Review*, 102 NW. U. L. REV. 1677 (2007) ("The problem of whether and how to extend favorable treatment to existing sources is a recurring one in environmental law."); Jonathan Remy Nash, *Allocation and Uncertainty: Strategic Responses to Environmental Grandfathering*, 36 ECOL. L. Q. 809, 811 (2009) ("Such systems have become increasingly common in the context of environmental and natural resource regulation."); Bruce Huber, *Transition Policy in Environmental Law*, 35 HARV. ENVTL. L. REV. 91, 92 (2011) ("This distinction reflects a recurring political problem faced by makers of environmental policy."); *See, e.g.*, Robert N. Stavins, *Vintage-Differentiated Environmental Regulation*, 25 STAN. ENVTL. L.J. 29 (2006).

regulations. Lawmakers seem particularly worried about negative impacts on capital.<sup>143</sup>

The normative discussion on grandfathering has been largely efficiency-oriented, centering on a discussion of how to allocate the "costs of legal transitions."<sup>144</sup> Louis Kaplow's seminal *Economic of Legal Transitions* argued against grandfathering on the grounds that legal transitions are not sufficiently different from other changes in the economic environment to warrant different treatment.<sup>145</sup> One might argue that in legal changes as in market changes, it is the private party that is better able to anticipate change.<sup>146</sup> The more compelling arguments, however, point out how a regime of grandfathering creates perverse incentives. There is obviously the transition relief itself, which could become the subject of rent-seeking.<sup>147</sup> Also, regulatory targets might, in anticipation of transition relief, have less incentive to anticipate very foreseeable legal changes, for example, as a result of emerging public health or safety concerns.<sup>148</sup> Additionally, in regimes where transition relief might be pegged to historical baselines, just a whiff of new regulation may send regulatory targets off in a race to boost their baselines in the hopes of securing a larger share of the impending transition relief.<sup>149</sup> And finally, policymakers have utterly failed to appreciate that grandfather status confers an asset in the form of a legal exemption which competitors have to observe, but not incumbents. This can be an enormous advantage, and a barrier to entry, as new entrants are required to spend hundreds of millions that incumbents do not.<sup>150</sup> This has the ironic effect of slowing capital turnover, because abandoning the capital

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143 Huber, *supra*, note 142, at 127 ("Both state and federal lawmakers have shied away from imposing the enormous costs associated with the mandatory retrofit, upgrade, or retirement of in-use diesel trucks...").

144 Huber, *supra*, note 142, at 92. See also, Louis Kaplow, *An Economic Analysis of Legal Transitions*, 99 HARV. L. REV. 509 (1986); DANIEL SHAVIRO, *WHEN RULES CHANGE: AN ECONOMIC AND POLITICAL ANALYSIS OF TRANSITION RELIEF AND RETROACTIVITY* (2000).

145 Kaplow, *supra*, note 144, at 513 (1986) ("As an initial hypothesis, government transitions warrant the same treatment as market transitions: no transition relief.").

146 Saul Levmore, *Changes, Anticipations, and Reparations*, 99 *Columbia L. Rev.* 1661, 1661-65 (1999).

147 Levmore, *supra*, note 146, at 1668-74.

148 Nash & Revesz, *supra*, note 142, at 1725.

149 Nash, *supra*, note 142, at 811; Shi-Ling Hsu & James E. Wilen, *Ecosystem Management and the 1996 Sustainable Fisheries Act*, 24 *Ecol. L. Q.* 799, 810 (1997).

150 Shi-Ling Hsu, *The Real Problem With New Source Review*, 36 *ENV. L. REP.* 10095, 10096 (2006).

also means abandoning the valuable asset (grandfather status), thereby delaying the achievement of air quality benefits.<sup>151</sup>

A number of arguments have been offered in favor of transition relief, but none are as general as the arguments against. Expensive, iterative technologically-based pollution control mandates may warrant some transition relief.<sup>152</sup> But the context in which transition relief is discussed is not often of such a clumsy command-and-control sort. It could also be that awarding transition relief is a second-best outcome, inferior to a policy change unaccompanied by transition relief, but better than the status quo.<sup>153</sup> But government's inability to ascertain the private costs and call a bluff is an invitation to rent-seeking that may swamp any potential private palliative benefits.<sup>154</sup> Finally, it has been argued that regulatory bodies, not capital investors, are in a better position to anticipate new regulation.<sup>155</sup> But to the extent that new regulation is meant to address changing market conditions and emergent harms of some product or process, it would seem to be capital investors, not regulatory bodies, that are likely to have superior information. It is their capital, after all, and in the first instance it would be capital investors undertaking the due diligence of vetting the soundness of their investment. For example, there is no reason to believe that the Environmental Protection Agency would have any advantage in anticipating the environmental risks of hydraulic fracturing than the oil and gas companies that engage in it.

But all of these arguments speak to behavior *after* the formation of capital. The less obvious, but possibly greater distortion is the *ex ante* effect that an expectation of grandfathering has on capital investment decisions. A substantial part of the risk of new capital is the risk of premature obsolescence, due to regulatory action, to the emergence of superior

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151 See, e.g., John A. List, Daniel L. Millimet & W. Warren McHone, *The Unintended Disincentive in the Clean Air Act*, 4 Adv. Econ. Anal. & Pol'y. Article 2, 14 (2004); Randy A. Nelson, Tom Tietenberg & Michael R. Donihue, *Differential Environmental Regulation: Effects of Electric Utility Capital Turnover and Emissions*, 75 REV. ECON. & STAT. 368 (1993); Hsu, *supra*, note 150, at 10096.

152 Steven Shavell, *On Optimal Legal Change, Past Behavior, and Grandfathering*, 37 J. LEGAL STUD. 37, 38 (2008).

153 Levmore, *supra*, note 146, at 1665-66; Jonathan S. Masur and Jonathan R. Nash, *The Institutional Dynamics of Transition Relief*, 85 N.Y.U. L. REV. 391, 400-01 (2010).

154 Levmore, *supra*, note 146, at 1666-68.

155 See, e.g., W. Kip Viscusi, *The Dangers of Unbounded Commitments to Regulate Risk*, 135-140, in RISKS, COSTS, AND LIVES SAVED (R.W. Hahn, ed., 1996).

alternatives, or due to some other unexpected shock. Absent risk, there is no reason that investors would abstain from super-sizing their capital investments. Insuring, even partially, against the risk of obsolescence by regulation biases investors towards larger capital investments. And all other things being equal, larger capital investments will inspire larger efforts to defend them.

It is thus not so much that grandfathering inhibits policy change because it delays compliance with updated standards of behavior (a common complaint from environmentalists),<sup>156</sup> it is that grandfathering inhibits policy change because it emboldens capital investors. Armed with the knowledge that legislatures and agencies will only reluctantly impose new costs, capital investors will, from a societal point of view, over-invest. Moreover, the more expensive the capital, the more reluctant lawmakers will be to regulate it.<sup>157</sup>

So common is the provision of at least some transition relief<sup>158</sup> that regulatory targets cannot help but notice,<sup>159</sup> and feel at least partially insured against changes in legal rules that might jeopardize their capital. The provision of transition relief has been elevated to almost norm status. Capital investors have come to expect a right to extract some profits out of their capital, regardless of its inherent usefulness, and regardless of the social harms it will impose, foreseeable or not. Transition relief, based on a misguided intuition, has made the obsolescence of capital everybody's problem. Everybody, that is, except the owners of obsolescent capital.

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156 See, e.g., Natural Resources Defense Council, One Earth, *Regulating Obesogens*, June 27, 2011 ("When TSCA was first passed, over 60,000 chemicals were "grandfathered" in, with no requirement for toxicity information to continue their production.... While rates of diseases linked to chemical exposures continue to rise, the federal system that is supposed to be protecting us is unable to do the job and millions of people are at risk."); online: <http://www.onearth.org/article/nrdc-regulating-obesogens>; See also, *Natural Resources Defense Council v. Thomas*, 838 F.2d 1224, 1243 (D.C. Cir. 1986) ("NRDC attacks several elements of the grandfathering as to generous.").

157 Huber, *supra*, note 142, at 127.

158 Maria Dimon, Daniel Cole, Thomas Sterner, and Elinor Ostrom, *Grandfathering*, Indiana University, Bloomington School of Public & Environmental Affairs Research Paper No. 2012-11-03 (2012), available at SSRN: <http://ssrn.com/abstract=2182573>.

159 Nash & Revesz, *supra*, note 142, at 1726 ("[w]hen the government enacts a new legal regime with transition relief, it sends a signal to society at large that, in general, changes in legal standards will not govern existing actors.").

E. Regulatory Takings Jurisprudence

If there were a legal development that would exemplify the misguided bias in favor of capital, it would be the rise in regulatory takings jurisprudence. For approximately the last thirty-five years, the Supreme Court has been extremely interested in scrutinizing land use regulations to see if they are so onerous as to constitute a regulatory taking of property triggering a Fifth Amendment requirement of compensation.<sup>160</sup> The effects of this doctrinal lurch towards property rights protection are not obvious. But more than any other legal or policy phenomenon, it reveals the one-sidedness with which laws and legal institutions (most prominently the Supreme Court) have come to view capital.

Justice Brennan's three-factor analysis in *Penn Central Transportation Co. v. New York*,<sup>161</sup> still the default test for what constitutes a regulatory taking requiring the payment of compensation, prominently includes consideration of "the extent to which the regulation has interfered with distinct investment-backed expectations."<sup>162</sup> Although the jurisprudence and the literature do not explicitly say so, investment-backed expectation interests are what judges think are the interests in a stream of benefits stemming from the exploitation of capital. In the numerous regulatory takings cases that followed *Penn Central*, it is obvious the extent to which courts have paid careful attention to what owners of capital expect.<sup>163</sup> It is less obvious that courts seem to have lost sight of the social welfare of regulation attacked by regulatory takings litigation.

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160 Joseph L. Sax, *Land Use Regulation: Time to Think About Fairness*, 50 Nat. Res. J. 455, 457 (2010) ("...the Court became more sympathetic to regulation, only to shift again starting around 1980. In recent decades, the more conservative majority on the Supreme Court has shown that the Court is, again, quite sympathetic to the constitutional claims of property owners.").

161 *Penn Central Transportation Co. v. New York*, 438 U.S. 104, 124 (1978). The three factors are: the character of the government action, economic impact upon the claimant, and the interference with investment-backed expectations. *Id.*

162 438 U.S. 104 at 124.

163 See, e.g., *Tahoe-Sierra Preservation Council, Inc. v. Tahoe Regional Planning Commission*, 535 U.S. 302, 352 (Rehnquist, C.J., Scalia, and Thomas, dissenting, noting the extent to which the duration of a moratorium interferes with investment-backed expectations); *Palazzolo v. Rhode Island*, 533 U.S. 606, 616 (2001) (noting that since the restriction pre-dated ownership of the property, the owner could not have had investment-backed expectations frustrated); *Eastern Enterprises v. Apfel*, 524 U.S. 498, 501 (holding that a requirement to make retroactive contributions to a fund for coal mine workers suffering from black lung disease frustrated petitioner's investment-backed expectations).

In *Lucas v. South Carolina Coastal Council*,<sup>164</sup> perhaps the most prominent beachhead for property rights advocates, the Court squarely focused itself on the impacts on the petitioning landowner, finding that a South Carolina statute, in blocking development of a residential lot on a barrier island otherwise crowded with houses, effectively deprived a land developer of "economically viable use of the land."<sup>165</sup> Justice Scalia's majority opinion stated that

at the time Lucas acquired these parcels, he was not legally obliged to obtain a permit from the Council in advance of any development activity. *His intention with respect to the lots was to do what the owners of the immediately adjacent parcels had already done: erect single-family residences. He commissioned architectural drawings for this purpose....* (emphasis added).<sup>166</sup>

Quite explicitly, Justice Scalia's opinion, as does the vast majority of regulatory takings cases, places the regulatory takings focus on the effects of regulation on the landowner. Very little is said anymore about the common law police power that has served as the general regulatory authority for state and local governments for decades.<sup>167</sup>

In *Rose Acre Farms v. United States*,<sup>168</sup> one of the largest egg producers in the United States challenged an emergency order by the U.S. Department of Agriculture to slaughter all of the chickens in three of Rose Acre's large chicken egg farms and to clean and sanitize them, following a series of salmonella outbreaks that were all traced to the three farms. Rose Acre was still allowed to sell the eggs in liquid form. Rose Acre still sued, claiming that its diminished profits constituted a regulatory taking. Astonishingly, The Court of Federal Claims agreed, ruling that the emergency health order did in fact take Rose Acre's property, awarding Rose Acre over \$6 million in damages. Applying the *Penn Central* test, the court held that the order interfered with Rose Acre's investment-backed expectations,<sup>169</sup> that the

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164 *Lucas v. South Carolina Coastal Council*, 505 U.S. 1003 (1992).

165 505 U.S. at 1016.

166 505 U.S. at 1008.

167 D. Benjamin Barros, *The Police Power and the Takings Clause*, 58 U. Miami L. Rev. 471, 472 ("The term 'police power' ,, has been ignored in contemporary takings jurisprudence.").

168 55 Fed. Cl. 643 (Fed. Cl. 2003), rev'd, 559 F.3d 1260 (Fed. Cir. 2009).

169 55 Fed. Cl. at 665.

*LATENT EXTERNALITIES*

economic impact upon Rose Acre was severe,<sup>170</sup> and that the character of the government action favored Rose Acre.<sup>171</sup> On appeal, the Court of Appeals for the Federal Circuit reversed,<sup>172</sup> but left intact the lower court's application of the investment-backed expectations part of the test.<sup>173</sup> Even as the court cautiously upheld an emergency public health measure to prevent the recurrence of a harm that had already sickened of hundreds of people, traceable to the petitioner's farms,<sup>174</sup> the court let stand the hopelessly one-sided part of the lower court's opinion on the effect on petitioner's capital.<sup>175</sup>

One could argue (many have) that property law in particular has gotten carried away with thinking about rights, and neglecting correlative duties.<sup>176</sup> The Supreme Court has certainly done its part to tilt the inquiry in that direction. When the Court has addressed the harm-prevention goals of a land use restriction, it has scrutinized the restrictions and their effectiveness, taking a skeptical view of the assertions of the land use regulatory agencies.<sup>177</sup> It is striking that regulatory takings law so consciously focuses on the welfare of capital, and not social welfare. Courts have been willing to expand the regulatory takings inquiry into a number of areas beyond land use regulation, including water,<sup>178</sup> offshore oil leasing,<sup>179</sup> governmental

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170 55 Fed. Cl. at 657-58.

171 55 Fed. Cl. at 659-61.

172 559 F.3d 1260 (Fed. Cir. 2009).

173 559 F.3d at 1275-76.

174 55 Fed. Cl. at 648-50.

175 559 F.3d at 1281.

176 Joseph W. Singer, *The Ownership Society and the Takings of Property: Castles, Investments, and Just Obligations*, 30 HARV. ENVTL L. REV. 309 (2006); Laura S Underkuffler, *Tahoe's Requiem: The Death of the Scalian View of Property and Justice*, 21 CONST. COMMENT. 727 (2004).

177 In *Lucas*, Justice Scalia, critical of Justice Blackmun's reliance on the common law police power to permit harm-preventing land use restrictions, Justice Scalia writes that "[i]n Justice Blackmun's view, even with respect to regulations that deprive an owner of all developmental or economically beneficial land uses, the test for required compensation is whether the legislature has recited a harm-preventing justification for its action.... Since such a justification can be formulated in practically every case, this amounts to a test of whether the legislature has a *stupid staff*." (emphasis added) 505 U.S., at 1025, n. 12.

178 *Klamath Irrigation Dist. v. United States*, 635 F.3d 505, 522 (Fed. Cir. 2011) (holding that a reduction in a water allocation under a state statute could be a regulatory taking if the allocation is reduced to fulfill trust obligations to Native Americans and to comply with the Endangered Species Act); *Tulare Lake Basin Water Storage Dist. v. United States*, 49 Fed. Cl. 313, 319 (2001) (holding that

contractual rights,<sup>180</sup> and intellectual property.<sup>181</sup> Electric utilities, facing losses due to new competition arising from deregulation<sup>182</sup> have even raised regulatory takings claims from *de*-regulation.<sup>183</sup> At bottom, regulatory takings law has sought to protect the expectation interests of owners of capital. This deference to capital owners on the one hand, and skepticism towards the regulator and the social harm on the other, is analogous to the one-sidedness with which we view the benefits and the costs of capital. The law, as we do, only seems to appreciate the benefits of capital formation, and not so much the costs.

All that said, a consensus seems to exist that the changes in regulatory takings law have been modest.<sup>184</sup> Regulatory takings jurisprudence over the last thirty years has *not* remade the legal landscape for land use regulation or for regulation generally. Regulatory takings law is not exhibit A for this article's thesis that capital-friendly law has created an overcapitalized economy. Rather, what the last three decades of regulatory takings law seems to show is how legal thinking reflects a *desire* to protect capital, to the detriment of less tangible, more diffuse but potentially much more important social, economic, environmental and public health interests. Moreover, Justices Scalia, Thomas, Roberts, and Alito, the four justices most inclined to uphold private property rights against governmental interference, may not be done.<sup>185</sup> Regulatory takings jurisprudence may still yet solidify a legal bias for entrenching capital.

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reducing water deliveries to comply with the Endangered Species Act was a physical taking).

179 *Union Oil v. Morton*, 512 F.2d 743 (9<sup>th</sup> Cir. 1975) (holding that the suspension of offshore oil drilling operations after a 1969 oil spill off the Southern California coast, pending an environmental review, is a taking).

180 *Stockton E. Water Dist. v. United States*, 583 F.3d 1344, 1368-69 (Fed. Cir. 2009) (holding that a water contract right-holder could assert a regulatory takings claim for breach).

181 *Philip Morris, Inc. v. Reilly*, 312 F.3d 24 (2002) (holding that intellectual property rights can be rights that can be the subject of a regulatory taking).

182 Discussed in Section III.B. *supra*.

183 Susan Rose-Ackerman and Jim Rossi, *Disentangling Deregulatory Takings*, 86 Va. L. Rev. 1435, 1457 (2000).

184 Sax, *supra*, note 160, at 455 ("The theoretical battle appears to be over, with no winners.").

185 See, e.g., Garrett Power, *Property Rights, the "Gang of Four" and the Fifth Vote: Stop the Beach Renourishment, Inc. v. Florida Department of the Environment*, 28 WIDENER L. J. 627 (2012) (arguing that the four justice inclined to uphold property rights are still casting for a fifth vote to overrule Penn Central).

F. The Politics of Human and Social Capital

All of these laws and regulations confer some preferential, or at least special status on physical capital. But what about social and human capital? It is less obvious, but potentially more important, that law, regulations, government policy and even private firms have inclinations to protect human and social capital. While laws do not explicitly or structurally favor human or social capital the way they privilege physical capital, it is clear that political institutions bias decisions towards preserving human and social capital. The pervasiveness of grandfathering is one example. Behind the desire to preserve physical capital lies the connected desire to preserve the jobs, know-how, and social networks that derive from operation of physical capital.

Unlike physical capital, human and social capital are most ardently supported in the legislative branch. For communities, businesses and industries that are heavily dependent upon their human and social capital, and for whom alternative existences seem remote and implausible, reform represents an existential threat to the owners of that capital. Elections in coal mining communities, for example, become single-issue elections, with coal jobs taking center stage.<sup>186</sup> In the 2012 election cycle, campaigns in coal country states such as Virginia, Kentucky, and Pennsylvania focused heavily on coal, drawing a number of Democrats into the coal camp.<sup>187</sup> In West Virginia, where President Obama is viscerally hated for his perceived hostility to coal,<sup>188</sup> the President was outpolled in several large counties in

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186 Jennifer Yachnin, *Republicans talk up coal, Keystone XL as economic themes take center stage*, Greenwire, August 29, 2012 (“Republican candidate Andy Barr [argued that ‘[T]his year alone, 2,000 Kentucky miners lost their jobs because of overregulation and Obama’s war on coal. For every mining job lost, three additional jobs are threatened.’”).

187 Josh Kurtz, *2 Democrats in close races profess strong support for coal in new TV ads*, E&E News PM, September 13, 2012 (“in Virginia, former Gov. Tim Kaine (D), who is locked in a tight open-seat race against former Sen. George Allen (R) lauched an ad today in which he touts the help his administration gave a coal plant in southwest Virginia when he was governor...[T]his state-of-the-art coal plant in southwest Virginia, where my wife’s from, created 2,500 new jobs.”... Meanwhile, in Pennsylvania’s 12<sup>th</sup> District, ... Rep. Mark Critz (D) began airing an ad that blisters the Obama administration for its environmental regulations. ‘Seven hundred coal jobs depended on building an air shaft at the Cumberland Mine...but we had to fight President Obama’s EPA to get it built.’”).

188 Manuel Quinones, *Appalachia Fights Back Against President's Coal Policies*, ENERGY & ENVIRONMENT DAILY, May 10, 2012.

the state's Democratic primary by a convicted felon, still incarcerated in Texas.<sup>189</sup>

Fortunately for coal-mining communities in West Virginia, they had the luck of being represented by former Senate majority leader Robert Byrd. In a five-decade-long career in the Senate, Byrd regularly championed coal mining communities, regularly foiling air pollution regulation efforts:

Arguments have been made that costs and dislocations caused by the compliance requirements of this legislation pale in comparison to the public health benefits. But what will we really have accomplished if we succeed in removing certain pollutants from the air and at the same time level the economies of whole communities and regions? Is that progress? Is that kind of devastation not even to be considered here? ... When mines are shut down, not only do miners and their families suffer but whole communities also suffer....<sup>190</sup>

What is it about coal mine workers and their communities that make them so invested in a livelihood so fraught with danger and disease?<sup>191</sup> Granted, culture, identity, and personal pride are at work. But part of the answer must also be that there is embedded but unpriced capital in coal mining. This not only includes the physical equipment for coal mining operations, but also

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189 *Id.*

190 136 Cong.Rec. S531-01, Tuesday, January 30, 1990.

191 U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, *Coal Mine Dust Exposures and Associated Health Outcomes A Review of Information Published Since 1995*, DHHS (NIOSH) Publication No. 2011-172 (2011). Pneumoconiosis. Online: <http://www.cdc.gov/niosh/docs/2011-172/pdfs/2011-172.pdf>; Figure 14 shows age-adjusted death rates (per million) for decedents age  $\geq 25$  years with coal workers' pneumoconiosis as the underlying cause of death—United States, 1968–2006, Figure 15 Years of potential life lost (YPLL) before age 65 and mean YPLL per decedent for decedents aged  $\geq 25$  years with coal workers' pneumoconiosis as the underlying cause of death—United States, 1968–2006. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, *Work Related Lung Disease Surveillance Report 1994*, DHHS (NIOSH) Publication No. 94-120 (1994). <http://www.cdc.gov/niosh/docs/94-120/pdfs/94-120.pdf>. Table 3-1. identifies coal mining as occupation on death certificate in 69% of pneumoconiosis related deaths between 1985-1990.

## *LATENT EXTERNALITIES*

potentially more importantly, a tremendous amount of social and human capital wrapped up in coal mining and its ancillary businesses.

By no means is coal mining special among resource industries. Rural communities in many resource exploitation industries have found political champions that have sought to protect the social fabric around which their economic and social lives are bound. Logging communities found an ally in the late U.S. Senator Slade Gorton:

"That preservation law has wreaked incomprehensible havoc on timber families who have had to live with prolonged uncertainty about their futures. All indices of human despair have gone through the roof in these communities: child abuse, spousal abuse, alcohol and substance abuse, divorce, adolescent depression and suicide attempts, bankruptcies, and illness. All of these have been exacerbated by the terrible and unintended consequences of the Endangered Species Act of 1973."<sup>192</sup>

And in the environmentally-minded state of Massachusetts, the uniformly Democratic Congressional delegation has consistently and vigorously fought fishing limitations set by the National Marine Fisheries Service (NMFS) under the Sustainable Fisheries Act.<sup>193</sup> Iconic liberal Congressman Barney Frank, who held a 92% favorability rating from the League of Conservation Voters when he retired in 2012,<sup>194</sup> has often led the charge. In a 2009 letter to National Oceanic and Atmospheric Administration (NOAA) Administrator Jane Lubchenco, Frank urged Dr. Lubchenco to "be willing to act on its own to ensure decisive and immediate action to implement revised regulations necessary to protect fishermen and fishing communities from unnecessary and often devastating financial hardship."<sup>195</sup> Several months later, after apparently receiving little mollification from Lubchenco,

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<sup>192</sup> 138 CONG. REC. S16,941-01 (daily ed. October 5, 1992) (statement of Sen. Gorton).

<sup>193</sup> 16 U.S.C. § 1801 et seq. (1996).

<sup>194</sup> League of Conservation Voters, National Environmental Scorecard, Representative Barney Frank, <http://scorecard.lcv.org/moc/barney-frank> (accessed August 8, 2013).

<sup>195</sup> Letter from Hon. Barney Frank, U.S. House of Representatives, to Jane Lubchenco, Administrator, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, October 26, 2009; online: [http://www.savingseafood.org/images/documents/congress/10\\_26\\_09\\_lubchenco\\_frank.pdf](http://www.savingseafood.org/images/documents/congress/10_26_09_lubchenco_frank.pdf).

Frank called for her resignation, putatively over agency misconduct.<sup>196</sup> Massachusetts Attorney General Martha Coakley, in suing NOAA earlier this year for setting tight fishing limits, complained of a "callous disregard for the well-being of New England fishermen," that will lead to the "extinction of an industry that for more than a century has been a part of the commercial and social fabric of New England..."<sup>197</sup>

What these statements exemplify is a rhetorical focus on jobs, families, and communities. In the vernacular of this article, they represent human capital and social capital, and in rural, resource-based economies, they represent capital in groups where capital is otherwise scarce. When human and social capital are the only assets belonging to an individual or a group, a threat to that capital sets up a particularly acute public choice problem – the interests of capital owners are *extremely* and intensely concentrated, as opposed to those that would benefit from environmental protection. This dependence on continued exploitation of capital can generate psychological effects that defy objective facts. Desperate owners of threatened capital will zealously reject notions that their practices and their capital have become harmful or anachronistic.

#### IV. Whither, Capital? A Refocus on Public Goods

It is important to emphasize what this article is *not* arguing. This article is not arguing that the formation of capital should *never* be promoted or subsidized, or that capital should never be protected. Public goods,<sup>198</sup> after all, are often capital goods, and this article is certainly not arguing that we should abandon direct government provision or funding for national defense, schools, parks, law enforcement and a judiciary, all of which are capital goods within the working definition set out in this paper.

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196 Matt Viser, *Frank, Tierney Call on NOAA's Chief Dismissal*, Boston.com, July 8, 2010; online: [http://www.boston.com/news/politics/politicalintelligence/2010/07/frank\\_calls\\_on.html](http://www.boston.com/news/politics/politicalintelligence/2010/07/frank_calls_on.html) (accessed August 8, 2013).

197 *Massachusetts v. United States Department of Commerce*, Civil Action No. \_\_\_, United States District Court, District of Massachusetts (Complaint, ¶17, ¶2); online: <http://www.mass.gov/ago/docs/press/2013/1-13-cv-11301.pdf>.

198 Public goods are non-excludable (meaning that once they are provided, people cannot be excluded from enjoying them), and non-rival (meaning that consumption by one individual does not detract from consumption by another). *See, e.g.*, ROBERT CAMERON MITCHELL AND RICHARD T. CARSON, USING SURVEYS TO VALUE PUBLIC GOODS 1-2 (1989).

## LATENT EXTERNALITIES

The conceptual difficulty is that public goods are rarely "pure," in that they are perfectly non-excludable and perfectly non-rival.<sup>199</sup> The question for government provision or funding of a given project then, is how "pure" of a public good is the project? There are certainly capital goods that are not purely public goods but may be quasi-public goods, and sufficiently possess public good characteristics as to warrant subsidization. Network goods, such as railroad lines, roads and highways, and ports all have at least some degree of public funding, direct or indirect.

But one reason that legal institutions have gotten into the bad habit of over-promoting capital is because some capital projects have looked enough like public goods to warrant subsidization. Certain capital projects hold the promise of conferring new positive externalities so as to apparently justify government funding or some other legal mechanism to promote its development. So how can meritorious public good-like projects be distinguished from the ordinary capital projects which require no public support, and are simply part of the overcapitalization problem?

One type of misguided motivation for promoting capital is an apparent desire for low commodity prices. Driving energy prices down and keeping them low appears to have been a central part of American industrial policy. An original justification for subsidies was to stimulate capital investment in the oil and gas industries, once considered undercapitalized and immature. Favorable tax rules incentivized exploration and production by reducing capital costs and uncertainty,<sup>200</sup> an effort that has been spectacularly successful.<sup>201</sup> Capital investment in these sectors is considerably higher than private investment alone would have achieved.<sup>202</sup> But well past the point at which the oil and gas industries in the United States could be considered immature, and past the point at which firms were unable to diversify risks of failure, the subsidies persisted. Once the old justifications became implausible, new justifications emerged: (i) that national security demanded an expansion of supply to reduce dependence upon unstable foreign

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199 *See, e.g.*, ROBERT CAMERON MITCHELL AND RICHARD T. CARSON, USING SURVEYS TO VALUE PUBLIC GOODS 1-2, n. 1 (1989) ("Pure public goods are characterized by the conditions of non-excludability and non-rivalry congestion between individuals who wish to use the good (citation omitted). ... In the real world, few public goods meet these strict conditions....").

200 Mona Hymel, *The United States' Experience with Energy-Based Tax Incentives: The Evidence Supporting Tax Incentives for Renewable Energy*, 38 LOYOLA UNIV. CHI. L. J. 43, 47 (2006).

201 Mead, *supra*, note 67, at 353.

202 Cox & Wright, *supra*, note 67, at 188-89; Mead, *supra*, note 67, at 352.

regimes,<sup>203</sup> and (ii) the maintenance of low consumer prices.<sup>204</sup> Such ex post rationalization of continued subsidies is a hallmark of an overcapitalized industry addicted to government support.

Promoting the formation of capital to maintain low commodity prices is mistaken thinking, because low commodity prices are not a public good. It is true that low energy prices spur all kinds of economic activity that might not have occurred without them. In that sense, capital producing low energy prices produces substantial positive externalities. But as the last half-century of energy development has demonstrated, fossil fuels are not the only way to produce low energy prices. But because of huge amounts of entrenched capital in the fossil fuel industries, change has been slow coming.

This pattern of initial government subsidization, followed by large capital inflows into a targeted sector, followed by a stubborn resistance to subsidy reform, repeats itself in a number of resource sectors. Agricultural subsidies in the United States have not only distorted markets, but also contributed to the capital intensification of agriculture.<sup>205</sup> Fisheries subsidies have created a larger fleet of larger fishing boats, exacerbating an over-capitalization problem and creating a persistent overfishing problem.<sup>206</sup> Unsurprisingly, reform in these and other capital-heavy sectors has been virtually impossible. And worthy of note, it has not necessarily been the absolute size of the costs of government support that is of such great importance to the capital-owning resource users; it is the relative importance of their capital in their otherwise capital-poor environments that motivate them to strongly resist reform.

Public policy towards the formation and protection of capital must clearly be refocused. The allure of low commodity prices, resource sector development, and economic development generally has detracted from what should be the focus of government provision and subsidization: public goods. Conceding that distinguishing public goods or quasi-public goods from ordinary capital projects is difficult, I propose one guiding principle: public goods or quasi-public goods are often *network goods*. Roads and

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203 KEITH CRANE, ANDREAS GOLDTHAU, MICHAEL TOMAN, THOMAS LIGHT, STUART E. JOHNSON, ALIREZA NADER, ANGEL RABASA, AND HARUN DOGO, IMPORTED OIL AND U.S. NATIONAL SECURITY 23 (Rand, 2009).

204 Hymel, *supra*, note 200, at 47-48.

205 *See, e.g.*, NORMAN MYERS AND JENNIFER KENT, PERVERSE SUBSIDIES: HOW TAX DOLLARS CAN UNDERCUT THE ENVIRONMENT AND THE ECONOMY (Island Press, 2001).

206 SUZANNE IUDICELLO, MICHAEL WEBER, AND ROBERT WIELAND, FISH, MARKETS, AND FISHERMEN: THE ECONOMICS OF OVERFISHING (Island Press, 1999).

## LATENT EXTERNALITIES

highways, railroad lines, telephone and telecommunications networks, fiber optic cables, and the internet itself are all network goods.<sup>207</sup> These goods have (or have had) the potential to dramatically expand commerce, by providing new means of transportation or communication. Network goods do not merely confer positive consumption externalities<sup>208</sup> or merely embody complementarity with other goods,<sup>209</sup> but rather provide either electronic or physical linkages among users or among nodes.<sup>210</sup> Networks embody some public good aspects in that there are large economies of scale involved, with marginal costs declining steeply with consumption.<sup>211</sup> Networks are also characterized by at least some degree of non-excludability and/or some degree of non-rival consumption.

I emphasize the support of network capital because the connectivity created by networks has the potential to deliver the kind of outsized economic benefits delivered by public goods. The opening up of channels of commerce is perhaps the most fundamental economic function of government. Commerce-facilitating networks produce the greatest gains when they lower the transaction costs of meeting and exchanging for persons and entities that otherwise have no previous relationship and are in that sense "unorganized."<sup>212</sup> Such a network must hold out the promise of a fruitful exchange, so access and cost are important. Carol Rose, in writing about the role of navigable waterways in promoting commerce, has characterized such spaces as "inherently public" space,<sup>213</sup> where the costs of utilization are so low that spontaneous, unorganized commerce can take place. Water-based commerce represents a vital stage in the economic development of almost every modern society. Similarly, the provision of railroads, roads, highways, and the internet each delivered, in their own

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207 For a general description of network "industries," see, Lawrence J. White, *U.S. Public Policy Toward Network Industries*, New York University, Center for Law and Business, Working Paper No. 98-019 (1997), available at SSRN: [http://papers.ssrn.com/abstract\\_id=164500](http://papers.ssrn.com/abstract_id=164500); and Shmuel S. Oren and Stephen A. Smith, *Critical Mass and Tariff Structure in Electronic Communications Markets*, 12 BELL. J. ECON. 467 (1981).

208 A positive consumption externality is the positive effect of additional consumption by others. See, e.g., Michael L. Katz and Carl Shapiro, *Network Externalities, Competition and Compatibility*, 75 AM ECON. REV. 424, 424 (1985).

209 White, *supra*, note 207, at 3.

210 White, *supra*, note 207, at 3.

211 Michael Hsu, *An Introduction to the Pricing of Electric Power Transmission*, 6 UTIL. POL'Y. 257, 257 (1997).

212 Carol M. Rose, *The Comedy of the Commons: Custom, Commerce, and Inherently Public Property*, 53 UNIV. CHI. L. REV. 711, 765 (1986).

213 Rose, *supra*, note 212, at 720-721.

time, a crucial connectivity that opened up entirely new sets of possible transactions, and produced previously unimaginable gains from trading.<sup>214</sup>

In the energy realm, there is one capital network worth promoting: electricity transmission lines. The traditional electricity paradigm of baseload power plants belonging to a vertically-integrated utility, operating as a regulated monopoly with exclusive access to a customer base, is gradually giving way to a deregulated, decentralized paradigm which would, in theory, include a variety of ways for electricity supply to meet demand. A deregulated and decentralized electricity supply system would include the entry of new energy sources, demand reduction and conservation measures, and pricing schemes aimed at smoothing consumption patterns, thereby reducing daily peak demands.<sup>215</sup> Crucial in a shift to a new electricity paradigm is the opening up of electricity markets to new entrants, and the introduction of competition for electricity consumers. Indeed, publicly-funded networks such as roads, highways, and rail lines have benefitted fossil fuel industries enormously by lowering the costs of transporting fossil fuels, a benefit that continues to afford fossil fuels an advantage over renewable energy sources.<sup>216</sup> To do this, a network of transmission lines that was designed to deliver baseload power to captive consumers must be technologically and economically transformed.<sup>217</sup> Care must be taken to ensure that network goods are instruments of competition,<sup>218</sup> as they would if transmission lines reduce the cost of delivering electricity and make possible a greater variety of electricity

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214 Just as an example, agricultural advances occurred with the expansion of crop varieties, which was made possible by the expansion of the railroad network. GOLDIN, *supra*, note 41, at 265.

215 See, e.g., Alexandra B. Klass and Elizabeth J. Wilson, *Interstate Transmission Challenges for Renewable Energy: a Federalism Mismatch*, 65 VAND. L. REV. 1801, 1811 (2012).

216 Alexandra B. Klass, *Tax Benefits, Property Rights, and Mandates: Considering the Future of Government Support for Renewable Energy*, 2 (February 22, 2013). Minnesota Legal Studies Research Paper No. 13-11. Available at SSRN: <http://ssrn.com/abstract=222298>.

217 See, e.g., Klass and Wilson, *supra*, note 215, at 1802. For a review of the complicated issues surrounding a revamping of the electric grid, see, PJM, A Survey of Transmission Cost Allocation Issues, Methods, and Practices (2010), online: <http://ftp.pjm.com/~media/documents/reports/20100310-transmission-allocation-cost-web.ashx>.

218 Severin Borenstein, James Bushnell, and Steven Stoff, *The Competitive Effects of Transmission Capacity in a Deregulated Electricity Industry* 31 RAND J. ECON. 294, 295 (1997).

generation sources, such as wind energy.<sup>219</sup> Among energy experts, energy stakeholders, and even among partisan politicians, there is broad agreement that the United States electricity transmission network dramatically needs upgrading.<sup>220</sup>

Transmission lines have many public good aspects. Regional transmission organizations, or RTOs, which are charged with operating most of the transmission capacity in the United States, have become regulated utilities. By requiring broad access to both electricity consumers and suppliers, which the 2005 Energy Policy Act requires of RTOs,<sup>221</sup> transmission lines are mandated to assume at least one public good characteristic: non-excludability. Thus, the development of a cost allocation mechanism, another thorny problem for the development of a transmission policy,<sup>222</sup> becomes necessary in order for RTOs to remain economically viable.

Distinguishing capital projects worth promoting from those not worth promoting is territory ripe for imprecision, to be sure. However, some guidance on capital investments is surely better than the indiscriminate, all-capital-is-good mindset embodied in existing law and policy.

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219 Wind energy is generally abundant where people are not, so that the most important barrier to entry for wind energy producers is access to electricity customers through the transmission grid. *See, e.g.*, U.S. Department of Energy, 20% Wind Energy by 2030 93-100 (2008); online: [http://www.20percentwind.org/20percent\\_wind\\_energy\\_report\\_revOct08.pdf](http://www.20percentwind.org/20percent_wind_energy_report_revOct08.pdf)

220 U.S. Department of Energy, National Transmission Grid Study (2002), online: <http://certs.lbl.gov/ntgs/main-screen.pdf>; Eric J. Lerner, *What's Wrong With the Electric Grid?* INDUSTRIAL PHYSICIST, October/November 2003, at 8, online: <http://www.aip.org/tip/INPHFA/vol-9/iss-5/p8.html>; Eric Hirst, *U.S. Transmission Capacity: Present Status and Future Prospects* (prepared for Edison Electric Institute and the U.S. Department of Energy, 2004), online: [http://www.gc.doe.gov/sites/prod/files/oeprod/DocumentsandMedia/transmission\\_capacity.pdf](http://www.gc.doe.gov/sites/prod/files/oeprod/DocumentsandMedia/transmission_capacity.pdf); Energy Security Analysis, Inc., *Meeting U.S. Transmission Needs* (prepared for the Edison Electric Institute, 2005), online: [http://www.eei.org/ourissues/ElectricityTransmission/Documents/meeting\\_trans\\_needs.pdf](http://www.eei.org/ourissues/ElectricityTransmission/Documents/meeting_trans_needs.pdf).

221 Energy Policy Act of 2005, *supra*, note 133, Sec. 1231. North America's electricity grid has been devolved to ten "regional transmission organizations," which are regulated by FERC and are mandated to play the regulated role of an electricity transmission network. *See, e.g.*, Federal Energy Regulatory Commission, Regional Transmission Organizations Map (2012), online: <http://www.ferc.gov/industries/electric/indus-act/rto/elec-ovr-rto-map.pdf>.

222 Hung-Po Chao and Stephen Peck, 10 J. REG. ECON. 25, 26 (1996); William Hogan, *Contract Networks for Electric Power Transmission*, 4 J. REG. ECON. 211, 212 (1992).

CONCLUSION

This paper is the beginning of an exploration of the role of physical, human, and social capital in perpetuating inefficient behavior long after it is recognized as obsolete. If capital is acquired for a very specific purpose, and cannot be re-deployed for another purpose, then any shift in production methods could effectively "strand" that capital and render it worthless. Especially for mass-produced goods, such as electricity, the cost of capital is large relative to the units in which the benefits flow back to the owner of capital. Payback of capital is accomplished over long time horizons, and over broad populations. When production is undertaken with methods that involve high capital costs and a stream of benefits that are small and widespread – and therefore involve a long payback – a stable pricing and regulatory environment becomes extremely important. A small change in the pricing environment amplified over its application to a large number of customers and transactions results in a potentially huge change. In such an environment, owners of capital can be forgiven for being a bit paranoid and obsessive about protecting their capital by protecting their economic and regulatory environment.

This article argues that legal rules have helped capital owners control their economic and regulatory environment, to the detriment of a broader society. Misguided policy and legal preferences have crept into legal rules and have not only promoted the formation of new capital, but also protected existing capital from regulatory interference. The problem is thus not just that government has become an insurer against obsolescence; it is that these legal rules insuring capital against obsolescence have biased the mix of capital towards obsolescence-prone capital. The result is a self-reinforcing inefficiency that grows over time, exacerbating latent environmental problems and making them harder to address.

This analysis takes public choice theory into new territory. A theory of capital introduces a new variable not previously considered carefully. The prominence of physical, human, and social capital requires explicit treatment of actors at the individual, firm or sub-industry levels, so as to identify incentive structures at a disaggregated scale. This theory of capital is an exposition of exactly what path-dependency means in the context of industry, firm, and individual and behavior. A theory of capital is a form of institutional analysis applied to the choice sets facing industries, firms, and individuals that engage in harmful or inefficient behavior.