CAPITAL RIGIDITIES, LATENT EXTERNALITIES

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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. However, capital is often durable, and during the natural life of capital, information may emerge that point to negative externalities, or to superior alternatives. A problem arises because legal rules and institutions tend to over-promote the formation of capital (mostly by subsidizing it), and over-protect existing capital. This has the effect of both creating too much capital and too large capital. Consequently, new regulation or policy change becomes more difficult, as capital owners will have a larger stake to defend, and will expend more resources to resist regulation or policy reform. By enacting legal rules to promote and protect capital, developed societies have unwittingly erected barriers to policy reform. Over time, economies have become less efficient, less nimble, and the source of more litigation.

This article examines legal rules surrounding the formation and protection of three forms of capital: physical, human, and social. All of these three forms of capital have the potential to be durable, generate a long-lived stream of benefits, and block policy reform. This article sets out a simple model illustrating how legal rules and institutions over-promote and over-protect these forms of capital, and how and when they block policy reform.

INTRODUCTION

Capital is good. Capital and labor are the two stylized inputs to production. Among economists, capital is universally regarded as positively related to economic growth. 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, has become 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.
deceptively 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. What is left? Capital. Furthermore, more capital is always better. Additional capital may or may not be worth its cost, but it never decreases productivity.

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 pertain to 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 produce greater net social benefits. In short, new information can render existing capital obsolete in a number of different ways. But even obsolete capital can be extremely difficult to dislodge, unless its owner can profitably redeploy it for another purpose. Attempts to regulate or internalize externalities, or attempts to mobilize competing capital, will be opposed by the owners of existing capital.


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.").

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).

Idiosyncratic exceptions may exist, but the Cobb-Douglas production function is almost never deployed with capital having an inverse relationship with productivity.
For example, 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. The low costs were made possible by abundant supplies of coal that could be extracted at relatively low costs. Thousands of coal-fired power plants were built, and a vast distribution network was built to mine coal and deliver it to these power plants. Over time, however, a great deal of information has emerged suggesting that although the costs of mining and burning coal are low, these direct costs are swamped by the social and environmental costs of coal mining and combustion. Also, new technologies and new sources of energy (most prominently natural gas) have emerged suggesting that coal is not even the cheapest fossil fuel for generating electricity. But the sprawling network

6 For a general history of coal, see Barbara Freese, Coal: A Human History (2003).
7 Freese, supra, note 6, at 6-7.
8 Freese, supra, note 6, at 118-26.
9 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 μg/m³ 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). 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).
10 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:
of coal production, distribution, and combustion is fixed. It cannot be easily redeployed in a low-carbon economy.\textsuperscript{11} This capital rigidity has created a huge number of parties with a tremendous stake in its continued existence.

If the only problem with capital was that it became obsolete over time, then the longevity of capital and the latency of negative externalities would be just one of many problems facing a modern society with imperfect information. In a smoothly functioning economy, obsolete capital would just be discarded. The risk of obsolescence would be properly borne by investors, since it would be reasonable to assume that they are in the best position to evaluate the risk of obsolescence.\textsuperscript{12} In such a world, there is no allocative inefficiency. However, in a society obsessed with capital, legal rules have sprung up that have indiscriminately promoted the formation of new capital and uncritically protected existing capital. These rules have lowered the cost of capital and protected capital from changes in legal rules. And the problem is not simply a wealth transfer from taxpayers and consumers to capital investors. The problem is that capital-friendly rules and institutions have biased the mix of capital so that the current capital stock runs a suboptimally high risk of obsolescence. Once investors anticipate that government will help insure capital against obsolescence, they will be systemically too risk-taking. The result is a net deadweight loss: the costs of risky investments will be greater than the benefits. The law has been anything but a passive observer; it has been central to the unfolding of this economic debacle.

The problem is worse still. As this article will illustrate, capital at greater risk of obsolescence can be risky because of a greater probability of obsolescence, or because of the higher cost of capital at risk. If it is the latter – and there is reason to believe that this is more common\textsuperscript{13} – investors will expend more effort to defend it from regulation and to resist policy reform.

\footnotesize{
\begin{itemize}
\item \textsuperscript{11} 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, \textit{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.
\item \textsuperscript{13} See Section II.C., \textit{infra}.
\end{itemize}
}
The transfer from taxpayers and consumers to investors, already allocatively inefficient, is actually self-reinforcing. Wealthy, developed societies are, through mistaken policies designed to foster economic growth, making their economies less flexible, less nimble, less able to adapt to change, and above all, less efficient. In a rapidly globalizing world economy and in a world characterized by rapidly emerging information about the environmental consequences of an industrial society, an aging, lumbering and anachronistic capital stock has already saddled the world with trillions of dollars of unnecessary deadweight loss.

In *The Rise and Decline of Nations*, the late economist Mancur Olson argued that special interest groups are to blame for unemployment, stagflation, and the ultimate economic decline of nations. Over time, Olson argues, a country with a stable political environment allows special interest groups to develop. These special interest groups exist only to engage in rent-seeking – the achievement of favorable government policy that secures above-normal wealth for members of the special interest group. Why else would members of special interest group pay dues, unless they expect the group to obtain benefits they could not obtain themselves as individuals? Over time, if enough special interest groups secure enough above-normal wealth, then what is left over is below-normal wealth for everybody else, and a resulting economic distortion that produces inefficiency. Such is the storyline of many developed countries that seem to suddenly find themselves grappling with chronic economic underperformance.

This article sets out a more specific explanation of the nature of special interests. It sets out a theory of what it is that special interest groups seek to protect, and how law and policy are unwitting accomplices in the economic strangulation of a wealthy society: they create and maintain capital, which creates incentives for rent-seeking. In his book, Olson is vague about the specific actions that special interest groups undertake in rent-seeking. In examining the legal rules and institutions that over-promote and over-protect capital, this article provides an in-depth examination of the nature of rent-seeking activity. Part I of this article sets out a working definition of

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16 *Supra*, note 14, at 41-47.
17 *Supra*, note 14, at 41-47.
18 *See, e.g.*, America's European Moment, THE ECONOMIST, January 5, 2013, at 7. ("The reason behind this lamentable outcome is the outsize influence of narrow interest groups—which marks a second, unhappy parallel with Europe.").
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 will explain how capital impedes policy reform, as well as what is meant in this article by "policy reform." Part III will explain how current laws and governmental structures either over-promote the formation of capital, or over-protect capital once it is formed or acquired. Part IV takes a step back and seeks to strike a balance between, on the one hand, preventing the overcapitalization of an economy, and on the other hand, recognizing the positive externalities of some forms of capital. This part also sets out some broad guidelines for legal policy towards capital. 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. 19 A fair amount of government policy seems to be oriented towards assisting with the acquisition of capital, especially for small businesses. 20 President Obama's economic stimulus packages of 2008 21 and 2009 22 included a temporary provision to allow an increased tax deduction for capital

19 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.


equipment purchased through 2013. 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. Capital worship may be even more pronounced in capital-poor developing countries. Prescriptions for lifting the economies of developing countries center upon the availability of capital. 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.

Economic policy often seems to embody an assumption that if it can contribute to something with broadly-distributed benefits, like low commodity prices, it should do so. It is the formation of capital, everyone seems to believe, that unleashes the industry and entrepreneurship of individuals and firms in an economic society. Whenever capital produces a broadly-distributed stream of benefits, it seems sensible to marshal the resources of government in forming capital.

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." Undergraduate textbooks simply model production as a function of just two types of inputs: capital and labor. In this simple heuristic sense, capital is every productive

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25 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 developing countries. HERNANDO DE SOTO, THE MYSTERY OF CAPITAL 5 (1999).
28 ADAM SMITH, AN INQUIRY INTO THE NATURE AND CAUSES OF THE WEALTH OF NATIONS 351 (1776).
asset that is not labor. This dichotomy is a gross 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.

These and a number of other definitional difficulties 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). Fundamentally, capital can be thought of as foregone current consumption foregone to produce more income tomorrow. In a similar vein, 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." In so doing, Solow acknowledges that capital can be "natural," and take the form of, say, a wetland that provides flood control, habitat, and water filtration services.

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29 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: 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).

30 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).

31 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.").

32 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.").


34 See, also, PETER KAREIVA, HEATHER TALLIS, TAYLOR H. RICKETTS, GRETCHEN C. DAILY, AND STEPHEN POLASKY, NATURAL CAPITAL: THEORY AND PRACTICE OF MAPPING ECOSYSTEM SERVICES (2011). "Natural capital" produces ecosystem services which are beneficial to a wide variety of industrial processes, including the provision of clean water.
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. By definition, capital is something of instrumental value, contributing to something outside of its own being.

There is potentially a third element to this definition of capital: costliness. Capital is often costly in that it requires resources to acquire. For purposes of this article, the sometimes costly nature of capital serves to accentuate the points raised in this article, but is not a necessary condition. Examples of capital provided in this article are costly, but need not be.

I consider three kinds of capital: physical, human, and social. There are many other kinds of assets to which the label of "capital" has been attached. 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.

*Physical capital* is capital that takes on a tangible, physical form. For example, a power plant, with a typical useful life of forty or fifty years is


36 Natural resources and environmental conditions can constitute "natural capital." See, e.g., Ostrom, *supra*, note 35, at 172; and KAREIVA, et al, *supra*, note 34. 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).
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, coupled with the long time horizons involved with in paying for such capital, lends urgency to the task of monitoring and managing, to the greatest extent possible, the regulatory and price environments.

*Human capital* is most often thought of as education and training. Generally speaking, the higher the education, the greater the value of the human capital. Education can be extremely costly, either or both in terms

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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 Energy Outlook 2013 4 (Table 1), online: [http://www.eia.gov/forecasts/aeo/er/pdf/electricity_generation.pdf](http://www.eia.gov/forecasts/aeo/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](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
of money or time, not only because of direct costs, but because of the opportunity costs of foregone income. But indisputably, there is a gap between observed productive output and the productive output that can be explained by the traditional Cobb-Douglas inputs of labor and capital. One element of that gap has been empirically attributed to the increased productivity of education and training, or the formation of what has come to be commonly referred to as human capital. Thus human capital is, by itself, something that generates a stream of benefits, in the form of earnings that would not otherwise be realized. While human capital is most easily conceived as formal schooling or on-the-job training, there are clearly many other forms of human capital. For example, Microsoft founder Bill Gates, a college dropout, owes a considerable amount of his wealth to the human capital he acquired at early stages of his life that enabled him to be one of the most innovative individuals in the history of humankind. 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. For those economists that engage with the concept of social capital, it is considered in terms of how it increases productivity, just other forms of capital do. After all, what good

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43 Goldin & Katz, supra, note 41, at 40.
45 For example, Becker's original empirical work focuses on the measurable benefits of schooling and on-the-job training. Becker, supra, note 31, at 17-21.
46 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.).
would social capital be, apart from the psychological benefits of social belonging?\textsuperscript{48} 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 \textit{Bowling Alone},\textsuperscript{49} 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 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.\textsuperscript{50}

Drawing again on the working definition of capital set forth in this article, \textit{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. Nevertheless, 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.\textsuperscript{51} 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.\textsuperscript{52} And the social capital plays a vital economic role, lubricating

\textsuperscript{48} Economists argue that joining social networks have non-economic benefits, and are at least in part the motivation for joining. \textit{See, e.g.}, Arrow, \textit{supra}, note 47, 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.")


\textsuperscript{50} \textit{See, e.g.}, Arrow, \textit{supra}, note 47, at 4.


\textsuperscript{52} \textit{Supra}, note 51, at S99.
merchantile relations in a very lucrative business while obviating the need for expensive and perhaps ultimately futile monitoring.\textsuperscript{53}

Social capital is perhaps the most egalitarian form of capital, requiring little of the financial resources that are necessary and sometimes unavailable to certain disadvantaged groups.\textsuperscript{54} Social capital could play a critical role in motivating poor, resource-based communities to fight regulation. Strong interconnectedness, like that found in the Jewish diamond broker industry, has been observed in a variety of fishing communities.\textsuperscript{55} As it happens, fishers are, even among resource industries, legend for their resistance to regulation.\textsuperscript{56} As in the Jewish diamond broker example, trust and reciprocity, the social capital that is formed from long-running business relationships and is formed for the purpose of maintain them – 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.\textsuperscript{57}

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.\textsuperscript{58} 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

\textsuperscript{53} Supra, note 51, at S99.

\textsuperscript{54} 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 49, at 359.


\textsuperscript{56} 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).

\textsuperscript{57} Sean Lauer, Relationships in Inshore Fisheries, 23 Sociological F. 503 (2008).

valuable than tangible assets like physical capital. Perhaps more significantly, it can be the only form of capital held by some individuals and some groups. In rural resource-based communities, social interactions tend to be concentrated in a small number of interaction sites, such as church, the town hall, the mine or plant, or the local bar.  

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 result in fruition. Physicality is just the most obvious aspect of capital.

II. How Does Capital Impede Policy Reform?

A. What is Policy Reform?

"Policy reform" in this article means broadly any change in legislation, regulation, or other form of law that has as its aim some welfare-increasing objective. Inevitably, of course, nothing is Pareto Superior and every significant policy reform imposes losses on some parties. Most obviously, a new regulation on certain practices of an industry could impose substantial costs on that industry, and the putative societal welfare gains would be of little consolation. In fact, welfare gains could just goad negatively-impacted industries into resisting policy reform for the purposes of extracting a side payment.

Policy reform could also take the form of liberalizations, such as the dismantling of regulation. Stigler's rent-seeking hypothesis – that industries could seek regulation to erect barriers to entry, thereby closing off markets to competition – also works in reverse. Industries could seek to block deregulation for fear of losing the value of their capital to competition from new entrants. It could be because an incumbent industry confers positive externalities, or because an incumbent industry wishes to protect its ossified and comfortable business model. Airline deregulation, which opened up


Civil aviation to new competition, drove airline profits down and created a new industry environment that remains highly competitive today. Not surprisingly, this was stridently opposed by incumbent airlines that enjoyed a price-regulated environment that guaranteed profit. Another example would be the start-and-stop movements towards electricity deregulation. Frantic hand-wringing by regulated electric utilities over "stranded costs," has stalled electricity deregulation, and even played a role in California's spectacularly failed lurch into electricity deregulation.

Similarly, policy reform could take the form of trade liberalization, another change in the legal and economic environment that usually holds promise of welfare gains. In this case, too, resistance to change is stoked by the threat of a new economic environment in which their capital could be less valuable because new competitors might have newer, more efficient capital, or because they have access to cheaper labor. Olson's theory of special interest tyranny in *The Rise and Decline of Nations* is predicated on a stasis in a trading environment; if there is some sort of a policy shock that opens up new trading possibilities (like a free trade agreement), special interest groups will at least initially be unable to organize prospective members to rent-seek. The most reliable opposition to the North American Free Trade Agreement (NAFTA), for example, came from the Midwest and Northeast, where aging industries feared competition from Mexican industries. It is

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63 Michael E. Levine, *Airline Deregulation and the Public Interest*, 44 Law & Contemp. Prob. 179, 193-94 ("Certainly the industry opposed deregulation, as did many members of Congress and the public, and this opposition was reflected in the timidity of the CAB's early efforts, as well as in the restrained tone of early legislative proposals.").

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


66 Supra, note 14, at 118-145.

67 David B. Holian, Timothy B. Krebs, and Michael H. Walsh, *Constituency Opinion, Ross Perot, and Roll-Call Behavior in the U.S. House: the Case of the NAFTA*, 22 LEGISL. STUD. Q. 369, 374 (1997) ("Since the early 1970s, legislators from particular regions of the country have opposed trade openness. This is especially true of members of Congress from "rust belt" states such as Illinois,
worth noting, as well, that perhaps the most vociferous opposition to NAFTA came from certain union groups. For these groups, it was the value of the human capital possessed by their members that they sought to protect. In a newly competitive environment, their human capital was feared to lose – and to some extent has actually lost – a great deal of value in a context in which this human capital was the only realistic source of income.

Policy reform can thus take on a number of forms. For the purposes of this article, another working definition is in order: policy reform is a change in legal rules offered for the purpose of achieving broad societal welfare gains, and which significantly affects the economic environment of some groups.

B. Public Choice Theory and Rent-Seeking

Public choice theory posits that the public policy sphere is driven by private interests: the private interests of the regulated entities and other interest groups, as well as the self-interests of regulatory agencies and the employees that staff them. Moreover, the greater the private interests at stake, the greater the effort will be expended to bend public policy to serve those private interests. In a legislative or a rulemaking process that represents significant policy reform, these efforts to resist reform are expended through lobbying efforts, civil litigation, public advertising campaigns, and strategic promises of campaign finance support for future
political actors. Of course, influencing government may take a variety of different forms. Anthony Downs's seminal *An Economic Theory of Democracy* posits actors in administrative agencies as working to further their own economic interests, rather than some stated public interest, and therefore open to exchanging regulatory favor for some other material benefit. Members of Congress may "facilitate" policy adjustments in federal agencies, which are acutely aware of their interdependence with Congress. Elected members of Congress are thus able to boost their re-election prospects by boasting to their local constituents (including local industries that may fund re-election campaigns) of the local benefits they have helped procure. The same mechanism would equally apply to efforts to resist or stall affirmative changes in law, such as trade liberalization or deregulation; Congress is just as interested in pleasing its constituents by preventing unfavorable changes in law.

As the world struggles with a plethora of new economic and environmental problems, capital continues to silently but powerfully play a role in defining the policy options. Some policy options, because they threaten the viability of existing capital, receive an effective death knell when they are tagged as politically unviable. But without a more probing inquiry as to exactly why these options are politically unviable, and why it can appear impossible to compensate owners for lost, or "stranded" capital, the role of capital remains a hidden one, taking certain options off the table without a satisfying explanation. Most importantly of all, it is important to understand the active role that law and policy have played in shaping these private interests. Insofar as law and policy have contributed to the entrenchment of inefficient capital, it is crucial to not only diagnose, but to treat this pathology.

C. The Nature of Rents Sought: Protecting a Benefit Stream

What exactly is the nature of those private interests that are so vigorously sought and protected by this kind of rent-seeking behavior? The source of resistance to regulation or economic change is not, as might be assumed, the compliance costs of environmental, financial or other regulation. It is not, as might be assumed, the initial or replacement cost of the capital that is

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76 ANTHONY DOWNS, *AN ECONOMIC THEORY OF DEMOCRACY*, ch. 6 (1957).

doomed by legal or policy change. The contribution of this article is the insight that those private interests are expectations of a stream of benefits flowing from the productive employment of threatened capital. In fact, Stigler's insight that industries might well demand regulation to block out new entrants is a special case of this broader thesis, in that regulated firms would willingly suffer compliance costs if they can increase their future stream of benefits by locking in a larger market share.

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, \( C_1 \), for the high-capital, high-profits strategy, and \( C_2 \) 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

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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 is compensation 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 $L2$. 
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.79 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 $L_1$ will always be greater than the loss $L_2$.

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 ($L_1$ or $L_2$), which could well exceed the cost of the capital ($C_1$ or $C_2$). So the amount of money spent on rent-seeking can be highly

sensitive initial decisions on capital investment. Just a subtle nudge, such as that provided by misguided law and policy, can magnify differences in capital investment, and lead to a very different world in terms of rent-seeking.

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 value of the stream of benefits, 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. An overcapitalized society is a rent-seeking society or rather, a rent-protecting society. 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 \( L_1 \) and \( L_2 \) 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 \( L_1 \) and \( L_2 \) can be more generally considered the net costs of being forced (economically or by regulation) to switch capital to a new use. \( L_1 \) and \( L_2 \) 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.
D. Overcapitalization as a Drag on Environmental Law and Policy Reform

In environmental law, where application of this thesis is most obvious, policy reform has been painstakingly slow. It is not just that controversial and costly proposals are vigorously opposed by regulated industries. Simple, administratively feasible, and common-sense reforms which easily pass cost-benefit tests seem to commonly fail.\textsuperscript{80} Prevailing explanations for the inertia of environmental law fall broadly into three categories: (i) public choice explanations,\textsuperscript{81} (ii) framing problems,\textsuperscript{82} and (iii) doubts about the importance of the underlying environmental problem.\textsuperscript{83} But while all of

\textsuperscript{80} 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 is illustrative. 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 was undertaken by Muller, Mendelson, and Nordhaus, \textit{supra}, note 9. Even under some restrictive assumptions, the authors find that their best estimates of gross external damages of seven industries exceed the value-added contributed by those seven industries. Those industries are stone quarrying, solid waste incineration, sewage treatment plants, oil- and coal-fired power plants, marinas, and petroleum-coal product manufacturing. \textit{Supra}, note 9, at

\textsuperscript{81} 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, \textit{THE CALCULUS OF CONSENT: LOGICAL FOUNDATIONS OF CONSTITUTIONAL DEMOCRACY} (1962); George J. Stigler, \textit{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, \textit{RESPONSIVE REGULATION: TRANSCENDING THE DEREGULATION DEBATE}, ch. 3 (1992).

\textsuperscript{82} 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, \textit{The Identifiability Bias in Environmental Law}, 35 FLA. ST. UNIV. L. REV. 433 (2008).

\textsuperscript{83} 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
these explanations have some explanatory power, the theory set out in this article – that capital impedes environmental policy reform – is the most broadly applicable. Just about every environmental or natural resource problem in the history of humankind has emerged in the middle of the economic life of some form of capital, be it physical, human, or social (or some combination of the three). Following on almost every single discovery of some environmental or natural resource harm, there is an individual, a firm, or an industry that cries foul because it has capital invested in the status quo, and does not want to confront the possibility that its capital may be producing more harms than goods. If the continued exploitation of capital creates environmental 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 environmental externality ever created. It is the partial story of how almost every environmental externality has been extended for longer than a rational society would have allowed it to persist. In some way, physical, human, or social 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 bricks and mortar that is easily priced and monetizable, but the human and social capital that is intertwined with existing industrial practices and processes that cause environmental harm. In a political arena, this may be an even more powerful source of inertia, as many groups of individuals have human capital that would be destroyed by drastic 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). For individuals that possess this capital, it is not the cost of acquiring that capital (which is often very low) but the stream of benefits that they expect to receive from it, be it continued employment or continued sustenance in a tightly-knit community. For many of these individuals, their role in an anachronistic industry may be the only realistic source of income or sustenance. What is worse, these kinds of human capital or social capital may not be re-deployable in another setting. The switching costs for these people are infinite. Were the source of income in this industries and communities to dry up, these people would essentially lose everything.

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 value to human or social capital in an anachronistic industry.

Overcapitalization plays a central role in the greatest environmental problem ever, and the greatest market failure 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. Coal, the most carbon-intensive of the fossil fuels, continues to play a central role in energy provision. Despite strong evidence that coal combustion, given its social and environmental costs and its contribution to climate change, is simply no longer worth it, coal combustion persists: most energy forecasts project an increase in coal production. The world's stock of coal-fired power plants, with a combined value in the trillions of dollars, does not seem readily abandoned by their owners. And it is not only the existing stock of coal-fired power plants that comprise the sluggish

84 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.

85 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).

86 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 9.

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

88 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.
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 has played a special role in blocking environmental law and policy reform. Perhaps more than even the 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. Discontinuation of a product or practice because of environmental side-effects can thus pose an existential threat to the owners of that capital.

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? While organizations, industries, and other capital owners operate within a set of legal rules that preside over their rent-seeking behavior, the focus of this article is on the role that law and policy play on the antecedent conditions that give rise to rent-seeking behavior – in this article, the resisting of welfare-enhancing policy reform by protecting capital. This article identifies two mechanisms by which law and policy create overcapitalized economies, and thereby generate policy inertia: (i) laws that promote the formation of capital, and (ii) rules protecting capital from changes in the economic or legal 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. Rules promoting the formation of capital thus impede policy reform by enlarging the private interests that would resist reform. Capital-friendly rules thus simply impede policy reform by raising the stakes, and raising the amount of money spent on resisting reform.

The latter mechanism, rules that protect capital, prolong the life of capital even when it is economically or environmentally obsolete. A rule grandfathering existing capital into older, less stringent regulatory schemes is one example.89 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

89 This is discussed in section II.C. below, infra.
unfavorable changes in legal rules or policy. If investors are even partially protected from obsolescence, then they will over-invest knowing that legal leniencies will at least partially insure them against obsolescence.

A skeptical libertarian might argue that capital needs promoting, and needs protecting because capital investors need protection from regulatory uncertainty. By this account, capital investment is chilled by the whim and caprice of regulators and the changing winds of politics. This argument, however, is only plausible in just a few idiosyncratic fields: antitrust enforcement and electricity deregulation. In antitrust law, capital investment could truly be chilled by the threat of antitrust enforcement, because it is truly difficult to foresee regulation or policy change. There is something inherently political about antitrust enforcement: the very delicate dividing line between natural and excessive industry concentration, between aggressive competition and undue market influence, and between logistical savings and undue tying arrangements are indications of exactly how difficult it is to discern the existence of a negative externality. But this normative ambiguity seems uniquely acute in the area of antitrust law; it would be overreaching to extend this argument into environmental law, products liability, energy regulation, or other areas in which industry is clearly overcapitalized. Moreover, in the United States, antitrust enforcement has not been highly controversial for nearly two decades, despite a recent push by the Obama Administration. The second area in which investment has been chilled by policy uncertainty is in the area of electricity deregulation. But as discussed below, the electricity industry

93 Klein, supra, note 92, at 160-161.
is one that has been chronically overcapitalized, so that chilling investment is efficient. This is particularly true if the chilling threat is the threat of welfare-enhancing deregulation, and the specter of more efficient capital. Outside of these two areas, evidence of regulatory overreach that chills capital investment is largely anecdotal. Even if regulatory overreach did chill investment, the correct response is to treat the regulatory overreach, not attempt to compensate by promoting the formation of capital.

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.

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).\(^97\) Equally clearly, subsidies have resulted in the formation of excess energy capital. 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.

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96 Discussed in section III.B. below.

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 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. Those subsidies are generally not targeted in this article.

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.

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. 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. 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

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99 Discussed in section IV., infra.
100 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.
101 Freese, supra, note 6 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.").
102 Discussed in subsection B. below.
tax rate. 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 the target of subsidies. 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 small, non-integrated oil and gas producers – 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.

So long as the expected life of the oil and gas well is greater than 6.67 years (100 ÷ 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 much more extreme 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. 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. 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, the three most valuable subsidies for the oil

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103 26 U.S.C. §631(c). Section 631 also applies to timber and iron ore.
104 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).
105 CRS Report, supra, note 97, at 3.
106 26 U.S.C. §263(c).
107 Id.
108 U.S. DEPARTMENT OF ENERGY, ENERGY INFORMATION ADMINISTRATION, DIRECT FINANCIAL INTERVENTIONS AND SUBSIDIES IN ENERGY IN FISCAL YEAR
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.\footnote{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 $13.9 billion, $11.5 billion, and $1.4 billion, all over ten years. CRS Report, \textit{supra}, note 97, at 3.}

Perhaps it is more important to consider the cumulative subsidies for oil and gas have affected capital investment patterns over time. Data limitations preclude a careful study. 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.\footnote{\textsc{Nancy Pfund and Ben Healey, \textit{What Would Jefferson Do? The Historical Role of Federal Subsidies in Shaping America’s Energy Future}} 29 (September 2011); online: \url{http://i.bnet.com/blogs/dbl_energy_subsidies_paper.pdf}.} But what has been the effect of this $447 billion subsidy on oil and gas capital formation? Would there have been a third less capital but for this infusion of federal money? Or to consider the polar opposite cases, would very little of this capital have been formed without the subsidy, or was the subsidy a pure wealth transfer, so that it had no effect at all on capital formation?

What would the effect of those subsidies be? How much capital was acquired by independent oil and gas producers because of those subsidies?\footnote{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, \textit{Oil & Gas Provisions in President Obama’s Proposed 2011 Budget} (no date); online: \url{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, \textit{supra}, note 97, and the EIA estimates of the cost for fiscal years 2007 and 2010, \textit{supra}, note ), these estimates are likely too low.} It is hard to make even an educated guess as to the elasticity of

\begin{verbatim}
2010 18 (Table 6) (July 2011); online: http://www.eia.gov/analysis/requests/subsidy/pdf/subsidy.pdf.
\end{verbatim}
capital in the oil and gas industry over the better part of a century of subsidized exploration and drilling. But it is surely worth noticing that the infusion of this magnitude of government money into an industry cannot help but change the decision dynamics of the industry. If we make an assumption unfriendly to the thesis of this article and assume that the $1.53 billion subsidy is just a transfer payment to oil and gas firms, but does not induce any extra capital formation, that still leaves the industry with an extra $1.53 billion per year with which to rent-seek! Even a fraction of that money is a lot of money to employ in the public policy arena. Finally, it bears repeating that oil and gas investments could be very sensitive to subsidies, and that a subsidy could magnify capital investment. Because a subsidy need only change the decision environment to have an effect, the induced capital investment could far exceed the amount of the subsidy; $1.53 billion could thus produce far more in capital investment.

President Obama has repeatedly proposed to phase out or eliminate subsidies for oil and gas companies. 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.

are more likely just the group's own estimates of the value of the withdrawn subsidies, not the absolute amount of withdrawn capital investments.

But with an exception discussed below, this is mistaken thinking, for the reasons proffered in this article. 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 suggesting that alternative energy sources are environmentally or economically superior? 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, it repeats the historical mistake of trying to accomplish an objective by exhorting the 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.

Producers of electricity from renewable energy sources benefit from a production tax credit, a unitary subsidy for each kilowatt-hour of electricity produced using a "qualified" production method. Section 1102 of the American Recovery and Reinvestment Act of 2009 (ARRA) allowed 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 for renewable energy providers, section 1603 of ARRA offers a cash grant in lieu of the

113 Discussed in section IV.B., infra.  
114 PFUND & HEALEY, supra, note 110.  
115 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").  
investment tax credit and the production tax credit. Providers of electricity from certain renewable energy sources may take a cash grant of ten or thirty percent, 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, and as a result expenditures for the grant totaled $4.2 billion in 2010, 84 percent of which went to wind projects. Meanwhile, the taxpayer costs of the production tax credit and the investment tax credit were $1.5 billion and $130 million in 2010, respectively. It was even an explicit goal of ARRA to inject money into the economy to assist in the economic recovery.

In addition, the Department of Energy operates several loan guarantee programs for qualifying projects or firms. Section 406 of ARRA, amending Title XVII of the Energy Policy Act of 2005, provides for loan guarantees for "renewable energy systems," "electric power transmission systems," and "leading-edge biofuel projects." By the end of 2010, DOE had issued over $25 billion in loan guarantees. It was under this program that DOE issued a loan guarantee to the failed solar energy company, Solyndra, which brought controversy to the program. Also controversially, DOE is authorized to guarantee 100% of a loan, not a more traditional fraction, like eighty percent. Some funding was also issued to aid in the construction of nuclear power plants. Overall, spending on renewable energy technologies was much greater than spending on fossil fuel technologies: more than $14 billion to just over $4 billion.

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119 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).
121 EIA Report, supra, note 115, at 13 (Table 3).
122 EIA Report, supra, note 115, at xi, at 5.
125 EIA Report, supra, note 115, at 59.
127 EIA Report, supra, note 115, at 59.
128 EIA Report, supra, note 115, at 64.
129 EIA Report, supra, note 115, at xiii (Table ES2).
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, and net summer capacity for wind energy grew from just about eight gigawatts in 2005 to over 39 gigawatts in 2010. 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 quickly than the previously favored solar technology, photovoltaics. 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. If there is a negative environmental externality, the right approach is to tax the negative externality, not to subsidize everything that does not produce the negative externality. It seems politically more palatable to subsidize "good" industries than it is to tax "bad" industries, but the politically expedient approach is less efficient. Among other problems with the pushing-on-a-string effectiveness of trying to prop up all that is putatively good, subsidizing "good" industries promotes the excessive formation of capital. A tax on a negative environmental externality is capital neutral. 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

130 EIA Report, supra, note 115, at xx (Table ES-5).
131 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.
133 HSU, supra, note 132, at 34-37.
134 HSU, supra, note 132, at 118-24.
135 HSU, supra, note 132, at 53-59.
136 HSU, supra, note 132, at 34-37.
137 HSU, supra, note 132, at 41-45.
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 benefits 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. But apparently following in the same industrial-development rationale that supposedly justifies energy subsidies, a variety of favorable tax provisions facilitate the formation of mining capital. Exploration and development expenses for mining companies, unlike for oil and gas companies, are deductible in full in the year those expenses are incurred. 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. In Canada, where mining is an important industry, 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. 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 some 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. Empirical research suggests that this has led to capital overinvestment in the mining industry.

141 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.ie.gc.ca/eic/site/cis-sic.nsf/eng/h_00013.html#vla2b.
and below-market returns to mining capital.\textsuperscript{144} 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.\textsuperscript{145} It has apparently succeeded in this respect.\textsuperscript{146}

The extraction of energy and other 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 growth paradigm that is the target of this article. There is no need, and indeed it is potentially very harmful, for government policy to actively stimulate economic growth by promoting the formation of capital. The oil and gas 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

\[ R = O + B \cdot r \]

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.\textsuperscript{147} 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."\textsuperscript{148} Although additions

\textsuperscript{144} Supra, note 143, at 127.
\textsuperscript{145} Supra, note 143, at 119.
\textsuperscript{146} Supra, note 143, at 125.
\textsuperscript{148} Harvey Averch & Leland L. Johnson, Behavior of the Firm under Regulatory Constraint, 52 Am. Econ. Rev. 1053 (1962).
to the company's rate base must be "prudently incurred," and must be "used and useful," 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. Empirical evidence for the Averch-Johnson effect is not unambiguous, but generally supportive.

Courts and commissions hearing ratemaking cases do not, however, seem overly concerned about the Averch-Johnson effect. In Limerick Nuclear Generating Station, 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. The Commission's glib dismissal of the Averch-Johnson effect reveals the bias of ratemaking bodies:


"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)


154 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
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.155

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-protecting, 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.156 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.157 As explained in this article,158 the expected stream of benefits could well be greater than the value of the capital stock. The specter of deregulation, which would have

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.

156 Brennan and Boyd supra, note 64, at 42.
158 See, note 164 and text accompanying, infra.
disadvantaged incumbent electricity generators, was enough for the industry to embark upon a massive campaign for compensation.\(^{159}\)

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\(^ {160}\) (requiring utilities to buy power from cogeneration sources and from renewable energy sources) and the 1992 Energy Policy Act\(^ {161}\) (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\(^ {162}\) and open up interstate transmission lines, under Order 888\(^ {163}\) (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.\(^ {164}\) 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


\(^{163}\) Order 888, FERC Stats. & Regs. ¶31,036 (1997).

\(^{164}\) Center for Responsive Politics, Electricity Deregulation (no date); online: http://www.opensecrets.org/news/issues/electricity/index.php.
have suspended their deregulation plans, including California, which suffered the most humiliating failures of deregulation. 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 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, 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, 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.


169 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.").
D. Grandfathering

Grandfathering, or more generally "transition relief," is a common practice in lawmaking, especially in environmental lawmaking. Because environmental regulation can severely affect the value of capital, environmental laws have often exempted existing capital from new laws or regulations. Environmental lawmakers seem particularly worried about negative impacts on capital.

The normative discussion on grandfathering has been largely efficiency-oriented, centering on a discussion of how to allocate the "costs of legal transitions." 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. One might argue that in legal changes as in market changes, it is the private party that is better able to anticipate change. 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. Regulatory targets might, in anticipation of transition relief, have less incentive to anticipate very foreseeable legal changes, for example, as a


171 Huber, *supra*, note 170, 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...").


173 Kaplow, *supra*, note 172, at 513 (1986) ("As an initial hypothesis, government transitions warrant the same treatment as market transitions: no transition relief.").


result of emerging public health or safety concerns. 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. 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. This has the ironic effect of slowing capital turnover, because abandoning the capital also means abandoning the valuable asset (grandfather status), thereby delaying the achievement of air quality benefits.

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. 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. 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. Finally, it has been argued that regulatory bodies, not capital investors, are in a better position to anticipate new regulation. But to the

176 Nash & Revesz, supra, note 170, at 1725.
182 Levmore, supra, note 12, at 1666-68.
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 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),184 it is that grandfathering inhibits policy change because it emboldens capital investors with the knowledge that legislatures and agencies will only reluctantly impose new costs. Moreover, the more expensive the capital, the more reluctant lawmakers will be to regulate it.185 So common is the provision of at least some transition relief186 that regulatory targets cannot help but notice,187 and feel

184 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.”).

185 Huber, supra, note 170, at 127.

186 Maria Dimon, Daniel Cole, Thomas Sterner, and Elinor Ostrom, Grandfathering, Indiana University, Bloomington School of Public &
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.

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. Taking a cue from the Supreme Court, lower courts have been willing to expand the regulatory takings inquiry into a number of areas beyond land use regulation, including water, offshore oil leasing, employer pension contributions,


187 Nash & Revesz, supra, note 170, 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.").

188 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.").

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

190 Union Oil v. Morton, 512 F.2d 743 (9th 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).

governmental contractual rights, and intellectual property. Electric utilities, facing losses due to new competition arising from deregulation have even raised regulatory takings claims from deregulation. Although this doctrinal lurch towards private property rights protection has unsettled environmental advocates and state and local governments, in the end, the changes have largely been incremental.

Justice Brennan's majority opinion in *Penn Central Transportation Co. v. New York* still sets out the default test for what constitutes a regulatory taking requiring the payment of compensation. Justice Brennan's three-factor test of an "essentially ad hoc, factual inquiry," prominently includes consideration of "the extent to which the regulation has interfered with distinct investment-backed expectations." 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, and could reasonably expect from their capital, and the extent to which government and the law may interfere with those expectations. It is less

192 *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).

193 *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).

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


197 Sax, *supra*, note 188, at 455 ("The theoretical battle appears to be over, with no winners.");


199 438 U.S. 104 at 124.

200 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
obvious that courts seem to have lost sight of the social welfare of regulation attacked by regulatory takings litigation.

In *Lucas v. South Carolina Coastal Council*,201 perhaps the most prominent beachhead for property rights advocates, the Court effectively skirted the *Penn Central* test, but 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."202 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).*203

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.204

In *Rose Acre Farms v. United States*,205 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. However, Rose Acre 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 retroactive contributions to a fund for coal mine workers suffering from black lung disease frustrated petitioner's investment-backed expectations).

202 505 U.S. at 1016.
203 505 U.S. at 1008.
204 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.").
205 55 Fed. Cl. 643 (Fed. Cl. 2003), rev'd, 559 F.3d 1260 (Fed. Cir. 2009).
Rose Acre over $6 million in damages. Applying the three-factor test in *Penn Central*, the court held that order interfered with Rose Acre's investment-backed expectations,\(^{206}\) that the economic impact upon Rose Acre was severe,\(^{207}\) and that the character of the government action favored Rose Acre.\(^{208}\) On appeal for the second time, the Court of Appeals for the Federal Circuit reversed the Court of Federal Claims decision,\(^{209}\) holding that the lower court misapplied the *Penn Central* test. However, the Court of Appeals left intact the lower court's application of the investment-backed expectations part of the test.\(^{210}\) Although the Court of Appeals held that measures to protect public health are generally, because of the character of such a governmental action, not compensable takings,\(^{211}\) it is somewhat surprising that it left intact the one-sided analysis of the investment-backed expectations branch of *Penn Central*. Even as the court cautiously found that a public health measure to prevent the recurrence of a harm that had already sickened of hundreds of people, traceable to the petitioner's farms,\(^{212}\) the court let stand the part of the lower court's opinion on the effect on petitioner's capital.

One could argue (many have) that property law in particular has gotten carried away with thinking about rights, and neglecting correlative duties.\(^{213}\) The 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.\(^{214}\) It is striking that regulatory takings law so consciously focuses on the welfare of

\(^{206}\) 55 Fed. Cl. at 665.
\(^{207}\) 55 Fed. Cl. at 657-58.
\(^{208}\) 55 Fed. Cl. at 659-61.
\(^{209}\) 559 F.3d 1260 (Fed. Cir. 2009).
\(^{210}\) 559 F.3d at 1275-76.
\(^{211}\) 559 F.3d at 1281.
\(^{212}\) 55 Fed. Cl. at 648-50.
\(^{214}\) 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.
capital, and not social welfare. 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.

But what is even more striking about regulatory takings jurisprudence over the last thirty years is that it 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. That may be true, but it is empirically hard to demonstrate, since the counterfactual is elusive, and property rights advocates could argue that regulatory uncertainty has inefficiently chilled investment. For all the hand-wringing over the elevation of private property rights over public interests, and for all of Justice Scalia's efforts, a consensus seems to exist that the changes in regulatory takings law have been modest. 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. Regulatory takings jurisprudence may still yet solidify a legal bias for protecting capital.

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 demonstrated inclinations to protect human and social capital. This plays out more in political arenas. Rural communities are held up as examples of parties that might be harmed by some environmental regulation. Voters in West Virginia, the site of many small coal-mining communities, voted heavily against President

215 Sax, supra, note 188, at 455.
216 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 justices inclined to uphold property rights are still casting for a fifth vote to overrule Penn Central).
Obama, still widely hated for his perceived hostility to coal. In the state's Democratic primary, incarcerated Texas felon Keith Judd outpolled Obama in several large counties. But why? Would it be so difficult to buy out, for example the entire state of West Virginia? The Gross State Product of West Virginia in 2010 was about $65 billion. Given the environmental externalities from coal combustion, would it be so prohibitively expensive to just shut down coal mining in West Virginia and compensate everybody? What is it about coal mine workers and their communities that make them so invested in a livelihood so fraught with danger and disease?

The answer must be that there is embedded but unpriced capital in coal mining. This not only includes the physical equipment marshaled for coal mining operations, but also potentially more importantly, a tremendous amount of social and human capital wrapped up in coal mining and its ancillary businesses. In 2012 Congressional races in coal country, political advertisements critical of the Obama Administration’s supposed hostility towards coal have prominently featured the jobs saved or created by coal-promoting projects, or supposedly lost to environmental regulation. As


218 Id.


220 Muller, et al, supra, note 9, at 1665 (Table 2, showing Gross External Damages of $53.4 billion per year).


222 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
in other resource-based communities possessing less human capital, social capital in coal mining communities may be the most "sticky" of all, since it may be the only form of capital for some individuals and communities, and may appear to provide the only possible stream of benefits for them. In such a context, a call to regulate coal mining poses a serious threat to this social capital, and poses an existential threat to these communities.

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, knowing that this pitted him against those seeking stronger regulation of air pollution:

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…. creating a series of ghost towns through northern Appalachia.224

This spirited and emotional defense is not limited to Byrd's defense of coal mining communities. Rural communities in many resource exploitation industries have found political champions that have sought to protect the

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 12th 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.’”).

223 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.’”).

social fabric around which their economic and social lives are bound.\textsuperscript{225} This is especially important for those resource communities in which human or physical capital is hard to come by, making their defense an important political litmus test. Rural communities always seem to enjoy outsized political clout, given their resources.\textsuperscript{226} There are even some government programs that seek to build social capital in rural communities, hoping to make them more productive.\textsuperscript{227} This is the sort of bane that this is the target of criticism in this article.

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.

\begin{itemize}
\item \textsuperscript{225} For example, this is from the late Senator Slade Gorton (R-WA): "That preservation 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." 138 \textit{CONG. REC.} S16,941-01 (daily ed. October 5, 1992)(statement of Sen. Gorton).
\item \textsuperscript{226} Ron Johnston, \textit{Manipulating maps and winning elections: measuring the impact of malapportionment and gerrymandering}, 21 \textit{POLIT. GEO.} 1, 17 (2002) (discussing how slow adjustment of district boundaries to population changes in the face of large flows of people from rural to urban districts in both the United States and England has caused disproportionate representation of rural areas); Cary M. Atlas, Thomas W. Gilligan, Robert J. Hendershott and Mark A. Zupan, \textit{Slicing the Federal Government Net Spending Pie: Who Wins, Who Loses, and Why}, 85 \textit{AM. ECON. REV.} 624 (1995) (showing disproportionate per capita representation in the Senate and a strong connected to a disproportionate receipt of federal funding); Michael Pal and Sujit Choudhry \textit{Is Every Ballot Equal? Visible-Minority Vote Dilution in Canada}, 13 \textit{IRPP Choices} 1, 6-8 (2007) (showing that rural ridings in Canada have a disproportionate representation in both federal and provincial Houses).
\item \textsuperscript{227} Gianluca Nardone, Roberta Sisto, Antonio Lopolito, \textit{Social Capital in the LEADER Initiative: a Methodological Approach}, 26 \textit{J. RURAL STUD.} 63 (2010).
\end{itemize}
IV. Whither, Capital? Positive Externalities From Capital

It is important to emphasize what this article is not arguing. It is not arguing for policies to actively discourage the formation of capital. Capital is good, and absent the legal biases described in this article, there is no reason to believe that investors would overlook the risks of obsolescence and social harms. This article is also not arguing that the formation of capital should never be promoted or subsidized, or that capital should never be protected. Capital does sometimes confer large positive externalities, and in some cases such capital should be promoted or subsidized.

What this article argues is that blanket policies to promote the formation of capital and mistaken policies to promote development of a specific industrial sector have saddled societies with the wrong kind of capital. What is needed is not a purge on all legal rules promoting the formation of capital, but some economic principles by which the utility of certain classes of capital investments may be roughly evaluated, ex ante. This article argues for a new legal approach to capital, one that more consciously evaluates two characteristics of capital: (i) the potential for conferring positive externalities, and (ii) the potential for obsolescence. These two factors can be thought of as competing considerations. When the potential for capital to confer positive externalities is high, it might be worth promoting even when it carries a high risk of obsolescence. Capital might also be promoted even if it has a low potential for positive externalities but also a low risk of obsolescence. This article identifies two forms of capital that are worth promoting: (i) network goods, because of their potential for conferring positive externalities, and (ii) certain adaptable forms of human capital, because of its low potential for obsolescence.

A. Network Goods

Roads and highways, railroad lines, telephone and telecommunications networks, fiber optic cables, and the internet itself are all network goods. These goods have (or have had) the potential to dramatically expand commerce, by providing new means of transportation or communication. As distinguished from goods that merely confer positive consumption

externalities or merely embody complementarity with other goods, network goods are goods that provide either electronic or physical linkages among users or among nodes. Networks embody some public good aspects in that there are large economies of scale involved, with marginal costs declining steeply with consumption. Networks are also, like public goods, characterized by at least some degree of non-excludability and/or some degree of non-rival consumption.

The connectivity created by networks has the potential to deliver outsized economic benefits. 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." 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, 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 time, a crucial reduction of transaction costs. In so doing, each network opened up entirely new sets of possible transactions, and produced previously unimaginable gains from trading. Agricultural advances occurred with the expansion of crop varieties, which was made possible by the expansion of the railroad network.

And yet what makes networks quasi-public goods is also what makes them capital-intensive, and also difficult to finance. Networks involve substantial start-up costs. For old-fashioned transportation networks, there are the high initial construction costs. In the parlance of this article, these are the costs of capital. Once completed, networks recoup the capital costs only in small

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229 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).
230 White, supra, note 228, at 3.
231 White, supra, note 228, at 3.
234 Rose, supra, note 233, at 720-721.
235 GOLDIN, supra, note 41, at 265.
increments. Moreover, in order for networks to have the maximum commerce-enhancing effect, access must be open and the costs low.

All of this strongly suggests that networks either need to be directly supplied by government or at least partially publicly financed. This is not obviously and broadly true, especially in the internet era in which private social networks such as Facebook have emerged, and have thrived without governmental involvement at all. But while Facebook and other social networks have some characteristics of a public good network, there is one important distinction: Facebook is providing a private, excludable good to its members in the form of its search function. In return for information about individuals, from which Facebook derives all of its value, Facebook will process that information and help individual members find valuable information. At bottom, Facebook, Google, and Amazon are all networks, but they trade in information, exchanging information with their members in private transactions. Its members, by the way, include advertisers, from which all of these networks derive most of their revenue. The excludable commodity that serves as the unit of trade in these networks is thus private information, and rents from participating in this network are, unlike the other networks discussed here, susceptible of pricing and exclusion. Public funding is not required.

Public funding is, however, required for one critical network previously discussed in this article: 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. 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. To do this, a network of transmission lines that was designed to deliver baseload power to captive consumers must be technologically and economically transformed.236 Care must be taken to ensure that network

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goods are instruments of competition,237 as they would if transmission lines reduce the cost of delivering electricity and make possible a greater variety of electricity generation sources, such as wind energy.238 Care must also be taken to ensure that network goods do not become instrumentalities of market power, as they would had electric utilities not been required to unbundle their assets under Order 888.239 But among energy experts, energy stakeholders, and even among partisan politicians, there is broad agreement that the United States electricity transmission network dramatically needs upgrading.240

Bundled into the numerous energy subsidies criticized in Section III.A. above are subsidies aimed at modernizing and enhancing the capacity of electricity transmission lines. Loans at favorable rates have been granted to the Bonneville Power Authority to mostly fund its transmission system.241 Most prominently, Section 402 of the ARRA authorizes the Department of Energy to issue loan guarantees, which it has to the tune of approximately $7 billion.242 While the total value of subsidies for transmission and distribution purposes declined from 2007 to 2010 – from about $1.08 billion in 2007 to $971 million in 2010243 – the impact could be greater, since more

238 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
239 Order 888 required utilities to unbundle their electricity generation, transmission, and distribution assets. Supra, note 163.
241 EIA Report, supra, note 115, at 47.
242 EIA Report, supra, note 115, at 65.
243 EIA Report, supra, note 115, at xi (Table ES1).
money has been directly injected into the energy sector through the stimulus-oriented ARRA.\textsuperscript{244}

Despite a risk of obsolescence – alternative means of generating or distributing electricity may be discovered – subsidies to promote the formation of transmission line capital are appropriate. A long-term vision of electricity supply with lower emissions places the electric grid at the center of efforts to introduce competition into the generation business, and to diversify and modernize the industry. In order for a wind farm in North Dakota to take advantage of its rich wind energy potential\textsuperscript{245} and to outcompete a coal-fired power plant for a consumer electricity market, it must have the means to deliver its electricity to population centers. In order for electricity markets to be truly competitive, and for supply to be more reliable, the current network of transmission lines must be expanded and improved. Innovation and competition are vital for not only reducing the carbon footprint of the most greenhouse gas-emitting industry in the world, but for transforming an ossified industry that, between 1960 and 1999, produced zero gains in average combustion efficiency.\textsuperscript{246} Mancur Olson's admonition that even healthy democracies strain under the yoke of special interest rent-seeking\textsuperscript{247} could not find a more fitting narrative than the 20th-century story of the electricity generation industry. And Olson's implicit prescription – that a stagnating economy be subjected to the shock of new and expanded trade pressures\textsuperscript{248} – could not find a more fitting patient.

Beyond electricity transmission lines, it is not so easy to determine whether a capital good is truly a network good or not, and hence whether it is worth promoting or not as a matter of government policy. Suffice it to say, it is very much worth bearing in mind the distinctions between network goods and positive consumption externalities, which do not necessarily generate new transactions. It is also important to avoid falling into the trap of conflating product complementarities and standardization as a means of

\textsuperscript{244} EIA Report, \textit{supra}, note 115, at xiv (Table ES2).

\textsuperscript{245} It is estimated that North Dakota alone has enough wind energy potential to generate 1.2 billion kilowatt-hours per year, or 36\% of total U.S. electricity consumption. U.S. Department of Energy, National Renewable Energy Laboratory, \textit{North Dakota: Wind Powering America} (April 2000), online: \texttt{http://www.nrel.gov/docs/fy00osti/28054.pdf}.


\textsuperscript{247} Olson, \textit{supra}, note 14, at 237.

\textsuperscript{248} Olson, \textit{supra}, note 14, at 118-145 (arguing that the introduction of the common European market served to make member states more competitive).
lowering transaction costs. True network goods create physical or virtual linkages, not just lower transaction costs.

B. Adaptable Human Capital

Policy reform is sometimes resisted by the owners of human capital that has become obsolete. The human capital that members of certain labor unions have is no longer, in the face of trade pressures from developing countries, economically sustainable; holding up trade liberalization is a response. Nor is human capital embedded in products and processes that are more socially harmful than beneficial of any value, at least as applied to those obsolete products or processes; holding up regulation is a response.

But like physical capital, human capital is an economic good and drives economic growth. Moreover, human capital can drive the adoption of new technologies, as higher-skilled workers with richer human capital generate better ideas and are more able to adapt to changes in technology. Better still, human capital can produce knowledge spillovers, as interactions among skilled individuals generate mutually beneficial enhancements to human capital. If human capital exhibits positive network effects, and has become the 21st century engine for economic growth, then it must be subsidized.

But how can reform-blocking, obsolescence-bound human capital be distinguished from the technology-forcing, positive externality-generating kind of human capital? How do we know what to subsidize? How do we know what human capital will create new possibilities and help push an

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250 Paul M. Romer, Endogenous Technical Change, 98 J. POLIT. ECON. S71, S99 (1990); Daron Acemoglu and Joshua Angrist, How Large are Human-Capital Externalities? Evidence from Compulsory Schooling Laws, in NBER MACROECONOMICS ANNUAL 2000 VOL. 15, 9 (2000), online:
http://www.nber.org/chapters/c11054.pdf

economy ahead, and what will become obsolete and induce resistance to reform?

A comprehensive answer requires an extensive treatment in labor economics, which is beyond the scope of this article. Some observations and some rough criteria, however, lay the groundwork for some more concrete recommendations.

First, all other things being equal, there is more likely to be an undersupply of human capital than for physical capital. From an individual viewpoint, human capital is a riskier investment than an investment in physical capital. That is say, if an expected return on physical capital such as a hot dog stand is equal to the expected return on human capital such as a bachelor's degree in English, a risk-averse individual would be more inclined to invest in the hot dog stand. That is because human capital cannot be bought or sold like physical capital can, so diversifying a capital stock requires more time and resources normally available to an individual.252 By contrast, the transferability of physical capital means that an individual does not need to diversify; a diversified economy does this.253 In light of this individual bias towards physical capital, a capital policy should generally be more generous towards human capital than physical capital.

Second, it is difficult to predict what the most useful form of capital will be just a few years in the future. But the more general the capital, the more flexible it will be, and the more likely it could be redeployed should a product or process become obsolete. Thus, while an employer is likely to seek out individuals with specialized human capital to plug into a production process, from a broader societal point of view, the more flexible and hence less risky human capital is of a more general form.

Third, there should be a time preference for human capital for younger people. Skills beget skills and learning begets learning, so that the earlier in life an individual acquires skills (i.e., forms human capital), the more likely she is to build on those skills to acquire other skills.254 If resources are scarce, then the best investment of government dollars for human capital promotion would target young children for early childhood learning and social skill development,255 not older workers for job retraining.256

253 Supra, note 252, at 950.
254 Heckman, supra, note 251, at 5 ("Early learning begets later learning…").
255 Heckman, supra, note 251, at 5-6.
Finally, human capital confers positive externalities in a way that physical capital generally does not. Human capital is knowledge, and the greater the stock of human capital, the greater the knowledge spillovers, and the higher the rate of accumulation of human capital. Knowledge begets more knowledge, and does so more easily if there is more knowledge to begin with. The formation of human capital should thus be made with a view toward taking advantage of positive consumption externalities.

Given these broad principles, it is possible to draw some conclusions about existing policies that touch on human capital. Firstly, research and development should be subsidized with caution. Although research and development is essentially the accumulation of human capital (and therefore more flexible than physical capital), it can still be wrapped up into an institutional and structural resistance to reform. All of the human capital wrapped up in the fossil fuel-based energy industry is part and parcel of a virulent and stubborn resistance to alternative energy technologies, which threatens existing capital by potentially developing competing human capital. In particular, if the accumulation of human capital is somehow tied up in the development of physical capital, then it is potentially worse than subsidizing physical capital: a firm may have a diversified portfolio of physical capital, but an individual generally does not have a diversified portfolio of human capital. In such cases, an individual would have an even greater incentive to protect her human capital than owners of physical capital.

Targeting a specific technology for research and development funding is risky because it runs the risk of obsolescence should the technology fail. Ironically, the more apparently "practical" is the application, the less flexible is the capital and the greater is the risk of obsolescence. For example, research and development funding has been provided for carbon capture and storage technologies (CCS) that can be attached to a coal-fired power plant to reduce carbon dioxide emissions.\footnote{Nigel Bankes, Anatole Boute, Steve Charnovitz, Shi-Ling Hsu, Sarah McCalla, Nicholas Rivers, and Liz Whitsett, \textit{International Trade and Investment Law and Carbon Management Technologies}, 3-4 (November 3, 2012). FSU College of Law, Public Law Research Paper No. 618. Available at SSRN: \url{http://ssrn.com/abstract=2171054} or \url{http://dx.doi.org/10.2139/ssrn.2171054}.} CCS research tends to be applied, mostly in the form of pilot projects in which private investors and the U.S. government share in the expense.\footnote{See, e.g, Frederic J. Frommer, \textit{Department of Energy Awarding $575 Million in Carbon Capture Research-and-Development Grants}, Huffington Post, http://www.huffingtonpost.com/2012/09/26/department-of-energy-575-million-carbon-capture_n_1886768.html.} The obvious appeal of CCS is
that capital surrounding the extraction, transportation, and combustion of coal for electricity generation can be left in place while reducing emissions. Not surprisingly, CCS projects enjoy a number of tax breaks aimed at constructing CCS facilities, hard physical capital that is intended to be seed projects for future CCS projects. This largesse comes despite recurring delays, persistent doubts from the industry side, and despite persistent problems with cost-ineffectiveness. Thus, despite the potential spillover benefits of human capital, subsidizing research and development for CCS would appear to be falling into the same trap that has snagged energy policy in the past.

Funding for renewable energy, which has increased dramatically under the Obama Administration, is only marginally more justifiable. It has long been accepted that nascent, or "infant" industries warrant some subsidization or trade protection because the accumulated human capital in those industries...
is so low that in order to survive, they need assistance. 263 In the case of renewable energies, not only are renewable energy industries nascent when compared with fossil fuel industries, but there is the additional externality in that renewable energies are cleaner than fossil fuel industries. This would seem to doubly warrant subsidization. 264 The United States government spent $632 million on research and development for renewable energy technologies in 2010. 265 The thinking with subsidizing renewable energy technology research is, as it is with CCS and fossil fuels, to lower the costs of energy by increasing the knowledge of how to deliver it. This knowledge is human capital. As such, it is attractive to believe that helping to form it would bring knowledge spillovers, and would justify subsidization. In fact, an economic argument has been made that the renewable energy sectors need some "catch-up" R&D because they have languished for years at a competitive disadvantage vis-à-vis fossil fuels, and have therefore are well behind in terms of accumulated human capital, leading to a chronic undersupply of renewable energy technologies for a long time. 266

Ultimately however, research and development in the renewable energy sector still tends to be quite specific. Learning how to better fabricate semiconductors used for solar photovoltaic cells, for example, would become obsolete human capital if, it is ultimately found that concentrated solar thermal heating is simpler and cheaper. 267 Targeting a specific industry


265 EIA Report, supra, note 115, at xvii (Table ES4).


267 Already, with a late start compared to solar photovoltaic energy, concentrating solar power plants could potentially generate electricity at between 3.5 and 6.2 cents per kilowatt hour by 2020, comparing favorably with solar photovoltaic energy. U.S. Department of Energy, Report to Congress on Assessment of Potential Impact of Concentrating Solar Power for Electricity
for additional human capital, if specific enough to that industry, is still taking a risky bet.

While the economic analysis is complicated, the economists' policy prescription for ramping up development of renewable energy technologies to reduce greenhouse gas emissions is not massive funding for renewable energy technologies. It is to levy a carbon tax to internalize the greenhouse gas emissions externality, accompanied by a modest amount of funding for some research and development in renewable energy technologies.\textsuperscript{268} A carbon tax spurs research and development activity only by presenting a price signal that emitting will be expensive. Human capital is best formed in response to this kind of a technology-neutral price signal, and not to an artificial and possibly temporary stimulus reflecting the shifting winds of a political fad.

Apart from the need to price an emissions externality, an improvement over funding specific energy strategies is to fund more general forms of knowledge. To diversify investments by adopting an "all-of-the-above" approach advocated by the Obama administration\textsuperscript{269} and supported by Republicans\textsuperscript{270} does nothing more than multiply error and create a multitude of human capital stocks that may later resist their obsolescence. A better investment for research and development funding is to fund more basic research. Put simply, there is no need for governmental involvement in research and development unless there is real reason to suspect that the research and development would be undersupplied. Basic research, because of its lack of immediate application, is apt to be undersupplied by the private sector. Indeed, economic theory suggests that when knowledge is specific to an industry, then subsidization is not necessary to spur research.


\textsuperscript{269} The "all-of-the-above" energy approach refers to the willingness to invest efforts in many energy technologies and strategies, including fossil fuel extraction and renewable energy technologies. See, e.g., Ken Salazar, \textit{All-of-the-Above, In Action}, The White House Blog, May 9, 2012, online: http://www.whitehouse.gov/blog/2012/05/09/all-above-action.

and development.\textsuperscript{271} If basic knowledge about delivering cleaner forms of electricity are desired, then instead of funding CCS or solar photovoltaic energy, funding into superconductivity technologies would be more flexible and ultimately more useful. The findings of superconductivity research could produce knowledge gains for critical energy problems, including transmission lines,\textsuperscript{272} transportation,\textsuperscript{273} energy storage,\textsuperscript{274} and even medical instrumentation.\textsuperscript{275}

An overarching suspicion that should be cast towards research and development funding is its targeting of adults, who demonstrably benefit less from human capital formation than children. If funds are limited – and they certainly seem to be these days – then funding for human capital is perhaps best directed towards primary and secondary public schooling, which is almost certainly too low. Economists Claudia Goldin and Lawrence Katz argue in their book, \textit{The Race Between Education and Technology}, that American economic dominance of most of the twentieth century was a product of its extraordinarily broad and egalitarian public schooling, which created a broadly educated work force that was able to adapt to a changing technological environment.\textsuperscript{276} Apart from generating outsized returns for young females\textsuperscript{277} and young African-Americans,\textsuperscript{278} widespread free public schooling generated positive network effects by lifting up an entire populace.\textsuperscript{279} Goldin and Katz argue that after 1970, the failure of the United States to replicate earlier successes and adapt public education for a changing technological environment largely explains the

\begin{itemize}
\item \textsuperscript{271} Murray C. Kemp, The Mill-Bastable Infant-Industry Dogma, 68 J. POLIT. ECON. 65, 65-67 (1960).
\item \textsuperscript{272} \textit{Superconductor Electricity Pipelines to be Adopted for America's First Renewable Energy Market Hub}, BUSINESSWIRE, October 13, 2009, online: \url{http://www.businesswire.com/news/home/20091013005203/en}.
\item \textsuperscript{273} Hiroyuki Fujimoto, Hiroki Kamijo, Takamitsu Higuchi, Yuichi Nakamura, and Ken Nagashima, \textit{Preliminary Study of a Superconduction Bulk Manget for the Maglev Train}, \textit{9 IEEE TRANSACTIONS ON APPLIED SUPERCONDUCTIVITY} 301 (1999).
\item \textsuperscript{274} Karen McNulty Walsh, \textit{Superconductors and Energy Storage}, 9 Innovation (2011), online: \url{http://www.innovation-america.org/superconductors-and-energy-storage}.
\item \textsuperscript{275} Thomas Sheahen, Introduction to High-Temperature Superconductivity 7 (1994).
\item \textsuperscript{276} \textit{GOLDIN & KATZ, Supra}, note 41, at 29.
\item \textsuperscript{277} \textit{GOLDIN & KATZ, Supra}, note 41, at 78 (Table 2.5, showing higher returns for education for women for college and business school, but not high school).
\item \textsuperscript{278} \textit{GOLDIN & KATZ, Supra}, note 41, at 21-23.
\item \textsuperscript{279} \textit{GOLDIN & KATZ, Supra}, note 41, at 29.
\end{itemize}
country's economic underperformance over this same period. Although elementary and secondary public schooling funding does not seem to be policy on capital, Goldin and Katz, building on the work of Nobel Laureate James Heckman, demonstrate that not only is educating children the formation of human capital, but is also important economic and industrial public policy. It is tempting to look at what is believed to be an "innovation deficit" and conclude that a market failure exists that government must fix. Ironically, however, those are precisely the problems that government must not fix.

C. Quasi-Public Goods

A broader way of thinking about capital worthy of subsidization is to consider the extent to which they are public goods, which are uncontroversially subsidized, if not directly supplied by government. Public goods such as national defense, parks, law enforcement and a judiciary, are also capital goods. No economist would dispute that these would be undersupplied absent direct government provision or at least taxpayer funding. But public goods are rarely "pure," in that they are perfectly non-excludable and perfectly non-rival. The question of government 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.

Transmission lines, which should be subsidized (if not provided outright by the federal government) have many public 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,  

280 Goldin & Katz, Supra, note 41, at 320-23.
281 A term used most often in the pharmaceutical industry, but applied broadly across many industrial sectors. See, e.g., Jurgen Drews and Stefan Ryser, Innovation Deficit in the Pharmaceutical Industry, 30 Drug Info. J. 97 (1996); Jason Potts, The Innovation Deficit in Public Services: the Curious Problem of Too Much Efficiency and Not Enough Waste and Failure, 11 Innovation: Mgmt., Pol'y & Practice 34 (2009); Heather Munroe-Blum and Peter MacKinnon, Canada's Innovation Deficit, Policy Options 8 (June 2009).
282 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....").
which the 2005 Energy Policy Act requires of RTOs, 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, becomes necessary in order for RTOs to remain economically viable. Human capital, as well, in certain instances, resemble public goods in that it is non-rival in consumption and to varying extents, is non-excludable. Knowledge is never exhausted by use, and when intellectual property rights imperfectly capture the rents from an innovation, it is also non-excludable.

It is challenging to consider which capital investments are worthwhile from a societal perspective, and which are likely to backfire and generate rent-seeking. Considering the extent to which capital goods resemble public goods provides some guide as to the necessity or desirability of promoting the formation of capital. Also, the potential for capital to confer positive externalities must be weighed against flexibility of the capital, and whether the switching costs of redeploying that capital for an alternative purpose introduce the risk of creating another drag on economic progress. This territory is 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.

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 electricity-generating 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.

What this article argues is that legal rules have helped capital owners control their economic and regulatory environment, to the detriment of a broader society. Misguided policy preferences have crept into legal rules and have not only promoted the formation of new capital, but also protected existing capital from regulatory interference, new competitive pressures, or virtually anything that threatens the profitability of capital. 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. The problem is only growing over time.

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. Significantly, it is not so much the capital itself that generates incentives to block policy reform. It is the stream of benefits over time that is jealously guarded by the owner of capital. This theory of capital explains why the amount of money devoted to rent-seeking or rent-protecting can exceed the cost of capital. And the new consideration of human and social capital provides a second explanation for the high value of rent-seeking or rent-protecting: the value of human capital or social capital may be at stake. The market value of capital thus may not completely capture its value as a generator of a stream of benefits, viewed in the context of the available alternatives. 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.