2005

Intellectual Property, Innovation, and Decentralized Decisions

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ESSAY

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INTRODUCTION

IN 1945, Fredrick Hayek described the problem of economic development as "a problem of the utilization of knowledge not given to anyone in its totality."[1] Hayek's insight has unexpected relevance for what has emerged as the central question in modern intellectual property and related fields: When might the assignment of property rights have anti-competitive consequences? The traditional, yet central, economic answer to this question emphasizes a tradeoff between incentives created by property grants and resulting higher prices and deadweight losses.[2] Under this model intellectual property grants are desirable to the extent that they encourage new product development at a reasonable cost.

Both the above quotation from Hayek and a growing body of scholarship suggest that this is the wrong way to assess the problem. This scholarship suggests that the most important economic effects of intellectual property may not be effects on price, but rather on *industry structure*. According to this view, we must weigh the benefits of intellectual property assign-

[*] Professor, Columbia Law School. I thank Kevin Outterson, Richard Posner, Randal Picker, Eric Posner, Mark Lemley, Lior Strahilevitz, Ed Felten, and Luis Garicano for the discussion and ideas that led to this paper. I also thank the participants in the Chicago Intellectual Property and Antitrust Seminar. This paper was drafted with the financial support of the University of Chicago. A related draft was presented at UCLA Law School and the Chicago Law School Work in Progress Workshop. I thank Wayne Hsiung for research assistance.

[1] F.A. Hayek, The Use of Knowledge in Society, 35 Am. Econ. Rev. 519, 520 (1945).

[2] See, e.g., Robert P. Merges, Intellectual Property Rights and the New Institutional Economics, 53 Vand. L. Rev. 1857, 1857–58 (2000) (discussing deadweight loss analysis and its limits).

ments, which include subsidizing or making possible desirable economic activity, against the costs of the centralization of economic decisionmaking and the creation of barriers to innovation and market entry.

This Essay discusses a crucial aspect of this problem: the effect of rights assignments on the decision architectures of affected industries.[3] Industry decisionmaking is not a topic of mere abstract interest. It is central to the economic performance of firms, industries, and entire nations. Professors Joseph Stiglitz and Raaj Sah have argued that different systems of product development may account for the variation in performances of planned and market economies.[5] Hayek similarly focused on decentralized versus centralized use of information as central to a "rational economic order."[6] To the extent that intellectual property assignments affect product development decisionmaking, and to the extent such assignments cover more and more industries, their effects may be fundamental to the performance of the economies of the future.

In the high-technology field, an example of the perils of centralized decisionmaking comes from Japan's "Fifth Generation Project." In the 1980s, the Japanese government, consulting with experts, predicted where computer technology would be in ten years. The government then launched a huge national effort to build the predicted technologies, hoping to leapfrog other countries. As a 1984 article explained,

[3] Some of the work relied upon includes Eric von Hippel, Democratizing Innovation (2005); Jane Jacobs, The Nature of Economies (2000); Paul Milgrom & John Roberts, Economics, Organization and Management 113–24 (1992); Patrick Bolton & Mathias Dewatripont, The Firm as a Communication Network, 109 Q.J. Econ. 809 (1994); Luis Garicano, Hierarchies and the Organization of Knowledge in Production, 108 J. Pol. Econ. 874 (2000); Mark A. Lemley, The Economics of Improvement in Intellectual Property Law, 75 Tex. L. Rev. 989 (1997); Raaj Kumar Sah & Joseph E. Stiglitz, The Architecture of Economic Systems: Hierarchies and Polyarchies, 76 Am. Econ. Rev. 716 (1986) [hereinafter Sah & Stiglitz, Hierarchries and Polyarchies]; Raaj K. Sah & Joseph E. Stiglitz, The Quality of Managers in Centralized Versus Decentralized Organizations, 106 Q.J. Econ. 289 (1991) [hereinafter Sah & Stiglitz, Centralized Versus Decentralized Organizations]; David S. Scharfstein & Jeremy C. Stein, Herd Behavior and Investment, 80 Am. Econ. Rev. 465 (1990).

[5] See Sah & Stiglitz, Hierarchies and Polyarchies, supra note 4, at 716, 726.

[6] See Hayek, supra note 1, at 524–28.

> [t]he Japanese are planning the miracle product. It will come not from their mines, their wells, their fields, or even their seas. It comes instead from their brains. . . . They're going to give the world the next generation—Fifth Generation—of computers, and those machines are going to be intelligent.[7]

The project was, unfortunately, centered on the mistaken belief that mainframe computers would remain dominant and that parallel supercomputing was the key to the future. It completely missed other less grandiose innovations, like the personal computer, the graphical user interface on the Apple Macintosh, and the computer networking now called the Internet. The project was an abject failure that damaged the Japanese computer industry. "[F]ew of the Fifth Generation project's original goals were achieved: Critics pronounced it a complete failure, while supporters were confined to citing collateral benefits such as researcher training."[8]

These points offer an important warning for industries regulated by intellectual property. While we may accept that intellectual property offers strong ex ante incentives to innovate (as did the Fifth Generation project), there is a flip-side danger of too much centralization of decisionmaking. Though the risk posed by governmental initiatives like Japan's Fifth Generation project may seem foreign, intellectual property policies practiced in the United States historically have created similar consequences. For example, in 1892, the United States granted an exceptionally broad patent to Thomas Edison for his light bulb. The result was to centralize light bulb decisionmaking in the Edison company for approximately twelve years.[9] The re-

[7] See Edward Feigenbaum & Pamela McCorduck, The Fifth Generation: Japan's Computer Challenge to the World, Creative Computing, Aug. 1984, at 103, 104, available at http://www.atarimagazines.com/creative/v10n8/103_The_fifth_generation_Jap.php.

[8] See Joel West, Utopianism and National Competitiveness in Technology Rhetoric: The Case of Japan's Information Infrastructure, 12 Info. Soc'y 251, 256(1996). I thank Ed Felten for this point.

[9] See Arthur A. Bright, Jr., The Electric-Lamp Industry: Technological Change and Economic Development from 1800 to 1947, at 88–91 (1949); Robert P. Merges & Richard R. Nelson, On the Complex Economics of Patent Scope, 90 Colum. L. Rev. 839, 885–88 (1990).

sults were not inspiring. Improvement in incandescent lighting became a one-company show, and many competitors were put out of business. Economists who have studied the period note that technological progress in lighting slowed, as "the broad Edison patent slowed down progress in the incandescent lighting field."[10]

The economic literature on decisionmaking architectures aids understanding of these scenarios. It makes an important and useful distinction between hierarchical (centralized) and polyarchical (decentralized) decision architectures.[11] In the former, decisions are made centrally by a few individuals with others providing support. A polyarchy, conversely, is characterized by multiple, potentially competing decisionmakers who may undertake projects independently. The key point of this Essay is that the government's decisions with respect to property assignments can steer decision architectures toward a polyarchical or hierarchical architecture. In general, broad rights or rights held by a limited number of parties promote a hierarchical decision architecture. Conversely, diffuse rights or non-assignment of rights leads to the market default: polyarchical decisionmaking architectures, where any firm or individual may decide to undertake a new project.

This distinction gives us a new perspective on when intellectual property rights should be assigned and their optimal scope. In general, the economic literature strongly favors decentralized decision structures in economic systems, based on the observation that free-market economies perform better than planned, centralized economies. Even accepting that useful incentives can be created by intellectual property, the effects on decisionmaking suggest a reason to be cautious about the assignment of broad rights. The danger is that centralization of investment decisionmaking may block the best or most innovative ideas from coming to market. This concern must be weighed against the desirable incentives and subsidies created by an intellectual property grant.

[10] Merges & Nelson, supra note 9, at 887.

[11] See, e.g., Sah & Stiglitz, Hierarchies and Polyarchies, supra note 4, at 716.

Two points must be raised against this presumption in favor of decentralized architectures. First, the danger of over-centralization can be moderated by numerous policies. The various exceptions and limitations to copyright and patent, such as the improvement doctrine in patent or the fair use doctrine in copyright, can help serve this function. One insight of this Essay is to suggest that the primary importance of such doctrines should be understood differently. They must be understood as justified by their promotion of decentralized decisionmaking in product development.

Second, despite this presumption in favor of decentralization, there also are certain scenarios where the economic literature suggests that hierarchical structures may perform better. Given an initial mixture of good and bad (profitable and unprofitable) ideas, hierarchies will tend to filter out too many good ideas but make fewer mistakes. Decentralized polyarchies, meanwhile, invest in more bad projects, and even outright fiascoes, but also more new and innovative ideas. There may be certain industries where avoidance of errors is of preeminent importance; for example, experiments with dangerous viruses or nuclear energy. In such instances, there may be special reasons to favor hierarchical product development.

Part I will introduce the distinction between hierarchies and polyarchical decision architectures. Part II will discuss the relationship between intellectual property and innovation policy. Part III will ask how the analysis in this Essay might influence intellectual property policy.

I. DECENTRALIZATION AND CENTRALIZATION

The economic literature has developed an overwhelming bias in favor of decentralized economic decisionmaking, reflecting the disastrous economic performance of planned economies. The basic argument was made most memorably by Fredrick Hayek and goes as follows.[12] Centralized economic planning, in a world of perfect information, has clear advantages over decentralized decisionmaking. Ideally, it eliminates duplication: two gas stations on a single street corner, provid-

[12] See Hayek, supra note 1, at 519, 524.

ing the same function, are wasteful, or "rent-dissipating." Central planning also eliminates many market failures such as externalities, collective action problems, and so on. The problem with centralized planning is not that it would not be efficient. The problem, rather, is that no central planner can possibly have all of the necessary local and national information to make the right decisions. As Hayek wrote:

> *If* we possess all the relevant information, *if* we can start out from a given system of preferences and *if* we command complete knowledge of available means, the problem which remains is purely one of logic. . . . This, however, is emphatically *not* the economic problem which society faces. . . . [T]he "data" from which the economic calculus starts are never for the whole society "given" to a single mind which could work out the implications, and can never be so given.[13]

The failure to appreciate these points in the twentieth century arguably led to various failed decisional experiments, such as China's Great Leap Forward or Stalin's five-year plans.

Since Hayek's time, other economists have taken new interest in the problems of decisionmaking and the transmission of information within organizations. As for Hayek, the central question across a variety of contexts is how performance is affected by centralization or decentralization of decisionmaking authority. For example, given a manufacturing firm that must choose among products to invest in developing, will the firm be more profitable if (1) decentralized units decide on products, or (2) every project is approved by a centralized structure before resources are committed?

The contemporary economic literature begins with a central assumption—one often missing from the existing legal intellectual property literature. The assumption is that human decisions are fallible.[14] Decisionmakers act on imperfect information for a number of reasons, including limited time and the

[13] Id. at 519.

[14] See Raaj K. Sah, Fallibility in Human Organizations and Political Systems, J. Econ. Persp., Spring 1991, at 67, 67–68 (discussing the assumption of human fallibility).

costs and erroneous nature of information transmission.[15] As a result, they make many mistakes. They cannot be certain, in advance, which of a portfolio of new products will actually be profitable and warrant investment. Product development and innovation, based on this simple assumption, is a highly error-prone exercise.

Based on that premise, economists have distinguished two basic decision architectures designed to weed out errors: polyarchies and hierarchies, corresponding to decentralized and centralized structures, respectively.[16] A polyarchy is a completely decentralized decision architecture: any single actor's approval of a project is sufficient. Conversely, in a hierarchy, the approval architecture is modeled as a serial decisionmaking process requiring all parties to approve a project for it to go forward. The simplest two-actor versions of each of these decision architectures can be pictured as follows in Figure 1

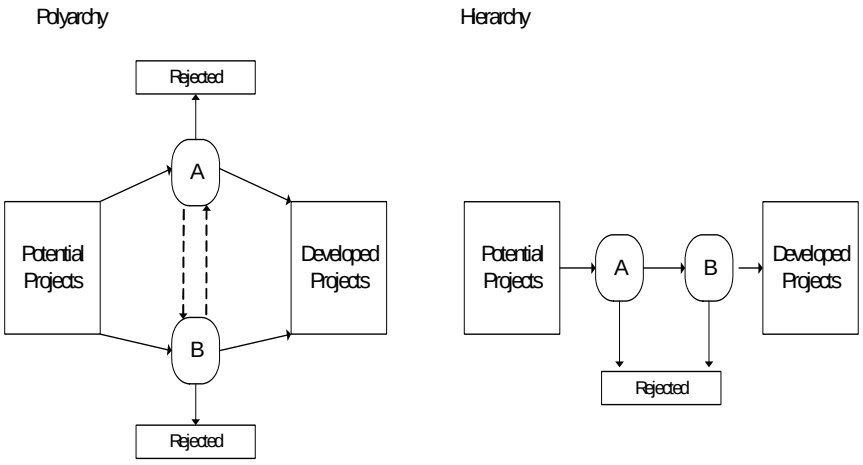

Figure 1: Polyarchy and Hierarchy

[15] See Bolton & Dewatripont, supra note 4, at 809–11.

[16] For more detailed models of polyarchies and hierarchies, see, for example, Patrick Bolton & Joseph Farrell, Decentralization, Duplication, and Delay, 98 J. Pol. Econ. 803, 803–06 (1990); Sah & Stiglitz, Hierarchies and Polyarchies, supra note 4, at 716.

As discussed above, a critical assumption is that in both systems, choosing successful products is difficult (this matches the real world, where a small percentage of new products succeed).[17] The relevant decisionmakers make two types of mistakes: they filter out projects that are in fact profitable (what statisticians call Type I errors) and also fail to squash projects destined to fail (Type II errors). The difference, then, is in the kinds of errors that dominate in a hierarchy and polyarchy. Under basic assumptions, a polyarchy like that described here will generally approve more projects than a hierarchy.[18] This can be shown intuitively based on the diagram above. If for a given project *P*, both *A* and *B* have a fifty percent chance of approving it, the polyarchy will approve the project seventy-percent of the time, while the hierarchy will approve it twenty-five percent of the time. As a result, the polyarchy will commit fewer errors of a "missed-opportunity" nature (Type I errors), but more errors of the "bad-investment" nature (Type II errors). The opposite is true for hierarchies: the cost of a hierarchy is a greater rejection of projects that should have been accepted.

Given their different capabilities, when will decentralized decision architectures outperform hierarchies and vice versa? That question is a topic of growing economic literature.[19] An

[17] See Booz, Allen & Hamilton Inc., New Products Management for the 1980s, at 2–3 (1982) (showing that most new products fail). There is related literature that tries to capitalize on a different mode of innovation to prevent errors, namely innovations created by "lead users." These users have particularized information as to how a product might be improved. See von Hippel, supra note 4, at 22–23.

[18] See Sah & Stiglitz, Hierarchies and Polyarchies, supra note 4, at 724–25.

[19] Other authors have focused on the nature of the relevant information to be transmitted as favoring either centralized or decentralized decisionmaking. Information that might be easier to transmit ("hard" information), like numbers, can be handled well by a hierarchy, while "soft" information, such as a subjective assessment of managerial ability, might be better processed by decentralized actors. See Jeremy C. Stein, Information Production and Capital Allocation: Decentralized Versus Hierarchical Firms, 57 J. Fin. 1891, 1891–93 (2002). Patrick Bolton and Joseph Farrell also have emphasized the relative quickness of centralized decisionmaking structures, which seems less important in the intellectual property context. See Bolton & Farrell, supra note 16, at 805–06, 816. This literature is not relevant here.

early but important answer to this question focuses on the relative scarcity of profitable ideas. Professors Joseph Stiglitz and Raaj Sah demonstrated that a polyarchy should be expected to outperform a hierarchy in an environment where profitable ideas are scarce and vice versa.[20] The reasoning follows from the premise: Since polyarchies by design reject fewer projects, they manage to capture the few available profitable ideas. Conversely, where good ideas are plentiful, polyarchies create waste by approving too many bad projects. A useful corollary is that the performance of a polyarchy or hierarchy depends on the information environment.[21] In a period of great change or uncertainty, the most fruitful line of inquiry may be difficult to ascertain, making the ability of polyarchies to turn up innovative ideas particularly useful. Conversely, in a highly stable environment, accuracy may be more important.[22]

This work, as we will see, has direct relevance to intellectual property problems.[23] But before exploring those questions we turn first to the traditional framework for understanding the relationship between intellectual property and innovation.

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[20] See Sah & Stiglitz, Hierarchies and Polyarchies, supra note 4, at 719.

[21] Cf. Joseph E. Stiglitz, Information and the Change in the Paradigm in Economics, Nobel Prize Lecture (Dec. 8, 2001), *in* Les Prix Nobel, The Nobel Prizes 2001, at 472, 503–06 (Tore Frangsmyr ed., 2002), available at http://nobelprize.org/economics/laureates/2001/stiglitz-lecture.pdf (discussing the effects of asymmetric information on behavior of individuals in the market).

[22] The evolutionary economics literature reaches similar results, albeit based on different assumptions and models that will not be detailed here. Professors Richard Nelson and Sidney Winter emphasized the uncertainty and contingency of technological outcomes. Their models predict multiple possible equilibria, rather than a single, predictable outcome. See Richard R. Nelson & Sidney G. Winter, An Evolutionary Theory of Economic Change 14–16 (1982). Firms depend on a set of routines that survive unless the firm dies or manages to mutate its way of doing business. That suggests, as does the decentralization literature, the importance of a trial-and-error approach to innovation decisionmaking in uncertain information environments.

[23] In other work, Sah and Stiglitz also showed that hierarchies tend to vary in quality much more than polyarchies. See Sah & Stiglitz, Centralized Versus Decentralized Organizations, supra note 4, at 289–90. In other words, a good hierarchical decisionmaking architecture will perform far better than a polyarchy, but a bad hierarchy makes the worst decisions of all. This is similar to the old point that the best monarchy is better than the best democracy, but the worst monarchy is worse than the worst democracy. Polyarchies in this view have something of a leveling effect on the quality of decisionmaking.

II. INTELLECTUAL PROPERTY AND INNOVATION

A. Costs and Benefits of Intellectual Property

The classic analysis of intellectual property and innovation is a comparison of dynamic benefits and static costs.[24] The benefit of a government's promise to grant intellectual property rights is the creation of incentives to invest in the research and development of new products. The static costs are measured as consumer deadweight loss resulting from higher pricing, the result of market power conferred by intellectual property. The optimal assignment of intellectual property rights must balance the incentives created against the deadweight loss. The graph usually used to show the costs of intellectual property is pictured in Figure 2.

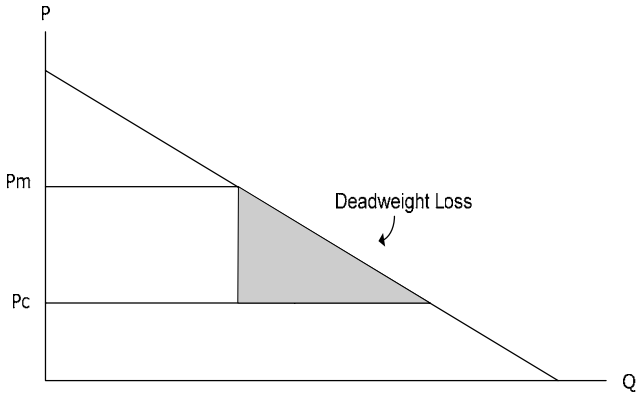

Figure 2: The Costs of Intellectual Property

This model remains the starting point, but today few believe that it delivers a full picture of the costs or benefits of intellectual property. The critical economic scholarship can be divided into three categories: one group emphasizing neglected costs, another group, neglected benefits, and a third challenging the model itself. On the cost side, a major insight is that property

[24] Richard A. Posner, Economic Analysis of Law 32–45 (6th ed. 2003).

rights can potentially create barriers to market entry. In patent, a number of authors have suggested that firms build patent "thickets" that block their more innovative competitors.[25] Professors Michael Heller and Rebecca Eisenberg have highlighted transaction costs made necessary by the collection of rights—what they term an "anti-commons" problem.[26] In other articles, Professor Randy Picker and I have written on the use of copyright to mediate or block the market entry of new dissemination technologies.[27]

On the benefit side, a number of scholars have suggested that the assignment of intellectual property rights may have static benefits—that IP rights may be useful independent of any incentives created. This remains a highly controversial proposition. The first to advance the argument was Professor Edmund Kitch, who argued that broad patent grants create "prospects" that can eliminate wasteful duplicative research and promote orderly development of a new invention.[28] Kitch's premise was disputed by Professors Robert Merges and Richard Nelson, based on a series of case studies of industries under broad patents.[29] Professor William Landes and Judge Richard Posner, while parting company with Kitch over the usefulness of prospect patents, do nonetheless emphasize the static benefits of intellectual property in other contexts, stress-

[25] See, e.g., Bronwyn H. Hall & Rosemarie Ham Ziedonis, The Patent Paradox Revisited: An Empirical Study of Patenting in the U.S. Semiconductor Industry, 1979–1995, 32 RAND J. Econ. 101, 102 (2001).

[26] Michael A. Heller & Rebecca S. Eisenberg, Can Patents Deter Innovation? The Anticommons in Biomedical Research, 280 Sci. 698, 698–700 (1998), available at http://www.sciencemag.org/cgi/content/full/280/5364/698.

[27] See Randal C. Picker, Copyright as Entry Policy: The Case of Digital Distribution, 47 Antitrust Bull. 423 (2002); Timothy Wu, Copyright's Communications Policy, 103 Mich. L. Rev. 278, 341–66 (2004).

[28] See Edmund W. Kitch, The Nature and Function of the Patent System, 20 J.L. & Econ. 265, 265–66, 278 (1977); see also Mark F. Grady & Jay I. Alexander, Patent Law and Rent Dissipation, 78 Va. L. Rev. 305, 308 (1992) (arguing that the purpose of patent is primarily preventing rent dissipation); Martin Campbell-Kelly & Patrick Valduriez, An Empirical Study of the Patent Prospect Theory: An Evaluation of Antispam Patents 1–5 (Sept. 1, 2005) (unpublished manuscript) available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=796289.

[29] Merges & Nelson, supra note 9, at 871–78, 884–915.

ing reductions of transaction costs.[30] Professor Clarisa Long has suggested that patents may be used by firms to signal their technological prowess.[31] Professor Douglas Lichtman's work also emphasizes static benefits, including price-coordination functions of intellectual property and evidentiary functions of copyright.[32] These static justifications for intellectual property are not accepted by everyone. Professor Mark Lemley, for example, calls them "ex post" justifications that are "strikingly anti-market."[33]

Finally, some challenge the economic assumptions underlying the model or address different models. Edmund Kitch, for example, is skeptical that the demand curve for intellectual propery-based products will have a negative slope and questions the assumption that intellectual property rights create real market power.[34] Mark Lemley suggests the model that fails to direct sufficient attention to how intellectual property law treats improvers, as opposed to the original inventors.[35]

Building on this literature, both in this Essay and other work,[36] I argue that we should assess intellectual property assignments by their effects on industry structure. In this model, the chief benefit of intellectual property is to subsidize selected industries whose assets are vulnerable to misappropriation. The chief costs are (1) the use of intellectual property rights to block or delay the market entry of threats to intellectual property owners, and (2) the centralization of decisionmaking

[30] See William M. Landes & Richard A. Posner, The Economic Structure of Intellectual Property Law 12–13, 318–25 (2003); Douglas Lichtman, Property Rights in Emerging Platform Technologies, 29 J. Legal Stud. 615, 619–20 (2000).

[31] See Clarisa Long, Patent Signals, 69 U. Chi. L. Rev. 625, 627–28, 643–44 (2002).

[32] See Douglas Lichtman, Copyright as a Rule of Evidence, 52 Duke L.J. 683, 686–87 (2003) (describing sections of copyright as motivated by an evidentiary function); Lichtman, supra note 31, at 619 (arguing that intellectual property law should encourage price coordination in emerging technology contexts).

[33] Mark A. Lemley, Ex Ante Versus Ex Post Justifications for Intellectual Property, 71 U. Chi. L. Rev. 129, 132 (2004).

[34] See Edmund W. Kitch, Elementary and Persistent Errors in the Economic Analysis of Intellectual Property, 53 Vand. L. Rev. 1727, 1729–31 (2000).

[35] Lemley, supra note 4, at 1048–67.

[36] See Wu, supra note 27; Timothy Wu, The Copyright Paradox, 2005 Sup. Ct. Rev. (forthcoming 2006).

within the industry. The intuition is not that other costs and benefits described in the literature are irrelevant, but rather that they are less significant to national economic performance than the long-term effects on industry structure.

The remainder of this section develops point (2) above by providing a means for assessing how intellectual property assignments may affect an industry's decisionmaking.

B. Model of Intellectual Property and Investment Decisions

The model presented here assesses intellectual property independent of the costs and benefits central to the monopoly pricing model. It assumes, initially, that both the incentives and deadweight losses are inconsequential in a competitive market.[37] The purpose is to emphasize a neglected consequence—the effect of property assignments on product development decisions in the industries influenced by intellectual property. The central argument is that the government's assignment of property rights can influence the decisionmaking architecture for the economic system surrounding a given intellectual property grant.

Consider an invention Y that will be a necessary component for a portfolio of possible products, named $P_1 \ldots P_n$. Some of the products will be profitable, others not, but consistent with our assumptions of imperfect information their profitability is hard to know in advance.

The government in our model has two policy options: (1) to award a patent to F_1 (the inventor) or (2) not to award this protection. The patent in this model gives F_1 an inalienable right to enjoin the use of Y. The right, in other words, cannot be licensed—like most of the royal grant of letters patent in seventeenth-century England.[38] Should the government decide to award the patent, the decisional consequences of that decision are as follows: F_1 has the sole authority to decide which of

[37] This is an unrealistic assumption for most industries. The assumption is relaxed in Part III.

[38] The assumption is relaxed later in this Part. For a description of the workings of English letters patent, see Thomas Nachbar, Monopoly, Mercantilism, and the Politics of Regulation, 91 Va. L. Rev. 1313, 1324–27 (2005).

$P_1 \ldots P_n$ is profitable and should be developed. While it can solicit advice and so on, the government, in our model, has mandated through patent that the final decision is F_1's to make. The resulting decision architecture can be pictured in Figure 3.

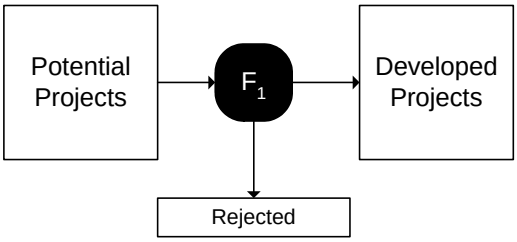

Figure 3: Decisional Consequences of Awarding Patent

Conversely, if government does not award a patent in Y, then a set of firms $F_1 \ldots F_n$ can decide to develop whatever products $P_1 \ldots P_n$ they think are profitable. That decision architecture is pictured in Figure 4 below.

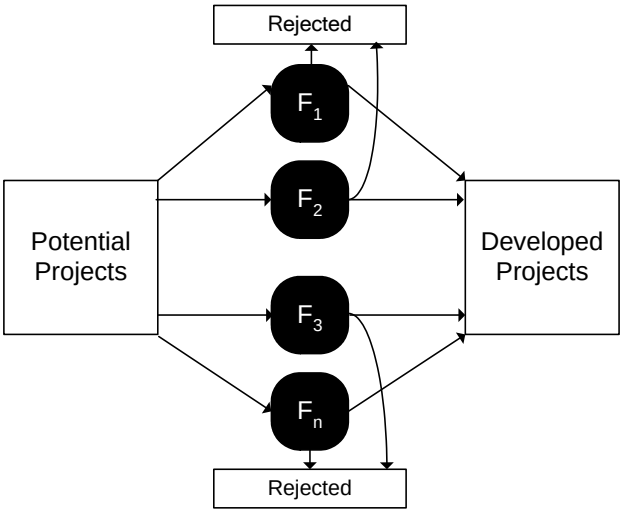

Figure 4: Decisional Consequences of Not Awarding Patent

A natural question is whether policy (1) or (2) will lead to higher profit and better economic performance. The consequence that this model emphasizes is the effect on the decision architecture surrounding invention *Y*. The results of the government's decision will be a wholly different pattern of product innovation and development. The centralized and decentralized decision structures will yield investments in different portfolios of products yielding different economic outcomes. Over time, the history of the industry dependent on *Y* may look very different.

A simple historical example may help illustrate the model. Consider an industry like the latenineteenth-century automobile industry, headed by a promising invention like the automobile.[39] In 1895, the U.S. government granted a patent in the automobile to a man named George Selden. It decided to allocate to Selden the authority to decide whether any project involving the basic elements of a car (an internal-combustion engine connected to a drive shaft) would go forward.[40] By this decision, the government created an initial decisional architecture for the automobile sector: a perfect hierarchy. Selden held the theoretical right to decide what projects to approve or disapprove in the car industry. Though there are many ideas as to what a profitable car might be, the power to make that decision rested entirely with Selden.[41]

At this point we can understand clearly the difference between the present model and the classic model. The idea that patent or copyright can block competition is a familiar part of the classic model. Yet its effect has been understood as blocking *price* competition, leading to deadweight loss. What the model here suggests is slightly different. It emphasizes the blocking of decisionmaking capacity among potential competitors to the rights holder. That is, the relevance of an intellectual property grant is not only that competitors cannot com-

[39] This example also is discussed in Merges & Nelson, supra note 9, at 888–91.

[40] U.S. Patent No. 549,160 (issued Nov. 5, 1895).

[41] As Robert Merges and Richard Nelson have documented, one could readily speculate that the effect of the Selden patent was to slow the development of automobiles for quite some time. See Merges & Nelson, supra note 9, at 888–90.

pete on price, but that they cannot develop projects that they consider profitable without the permission of the rights-owner.

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The most unrealistic assumption of the model just described is that the patent right in question cannot be transferred or licensed. While inalienable rights were usually the original model of royal letters patent[42] and still exist to some extent, inalienable rights are no longer the dominant model. In U.S. patent and copyright law, the initial allocation of decisionmaking authority is not a final allocation.[43] The rights holder can either create a decentralized decision structure within his own firm or license others to use the invention in an open manner, if doing so would yield maximum profitability.

What happens when we relax the assumption of inalienability? This leads to an analysis of what decisions the rights holder will make. The two questions are (1) whether the rights holder will create an efficiently decentralized internal structure[44] and (2) whether the rights holder will license efficiently to create an optimal decisional structure. A basic insight is that the initial inventor will often but not always create either an efficient internal structure or license when doing so would be socially optimal.

The first question suggests that to the extent that overly centralized decisionmaking might be sub-optimal, we might expect the rights holder to create a decentralized product development system within the firm. Unfortunately, the challenges of creating decentralized structures within firms are well known.[45] The reason is that minimal firm coherence requires uniformity in many practices, such as personnel, firm culture, and other internal rules. The resulting in-firm decentralization may be incomplete and artificial.[46] Generally speak-

[42] See Nachbar, supra note 38, at 1326–27.

[43] See, e.g., 17 U.S.C. § 201 (2000).

[44] The assumption of inalienability is irrelevant to this question.

[45] See Richard A. Posner, Preventing Surprise Attacks: Intelligence Reform in the Wake of 9/11, at 127–62 (2005).

[46] For further discussion of the idea in the intelligence sector, see id. at 134–38.

ing, a system of competing firms better resembles a decentralized decisional architecture than a large firm that has created internal decentralization.

The second question raises a familiar problem in both the intellectual property and telecommunications literature: the problem of efficient licensing.[47] In general, we should expect a firm to license its intellectual property to maximize subsequent innovation because that maximizes the licensing value of the property in the first place.[48] There are, however, a number of exceptions to this observation. We can consider three scenarios where efficient licensing so as to create appropriately decentralized decisionmaking may not occur.

The first may be found where the firm is subject to extensive government pricing regulations. In such a case, a firm may have strong reasons to want to keep its inventions to itself—namely, the prospect of unregulated revenue.[49] If, for example, Bell's central technology (voice) is subject to price caps, it may keep a new technology (DSL) to itself to try and capture the monopoly profits it is denied in its primary market. This point is simply a corollary of Baxter's law, which suggests that regulated monopolists, unlike other monopolists, may rationally seek monopoly profits in vertical input industries.[50]

A second exception arises in the presence of positive public externalities. These are scenarios where broad licensing would be good for society but where the benefits are hard for the rights holder to capture and even potentially harmful to it.[51]

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[47] For a discussion of where platform owners license efficiently, see Joseph Farrell & Philip J. Weiser, Modularity, Vertical Integration, and Open Access Policies: Towards a Convergence of Antitrust and Regulation in the Internet Age, 17 Harv. J.L. & Tech. 85, 97–101 (2003).

[48] For a discussion of related issues, see Lemley, supra note 4.

[49] Cf. Roger G. Noll & Bruce M. Owen, The Anticompetitive Uses of Regulation: *United States v. AT&T*, *in* The Antitrust Revolution 290, 291–95 (John E. Kwoka, Jr. & Lawrence J. White eds., 1989) (describing how the Bell System performed well and prospered under the regime of regulated monopoly).

[50] See William F. Baxter, Conditions Creating Antitrust Concerns with Vertical Integration by Regulated Industries--'For Whom the Bell Doctrine Tolls, '52 Antitrust L.J. 243 (1983) (describing what William Baxter modestly called the "Bell Doctrine," and what others call Baxter's Law).

[51] This view also is expressed in the argument that monopolists typically have reduced incentives to innovate. See Kenneth J. Arrow, Economic Welfare and

This can happen when the inventing firm is a dominant firm using the prior technology.[52] For example, in the automobile example, the owner of the car patent also might be a dominant manufacturer of horse-drawn buggies. In that case, the manufacturer might want to screen inventions that might challenge the buggy(like passenger sedans) favoring instead inventions that are no challenge to its existing market position (like tractors). The history of copyright and communications technologies typifies this problem, where the holders of copyright block or slow dissemination technologies of potentially broad social value that threaten an existing market position.[53] Television broadcasters, for example, blocked cable television,[54] and over the last decade the existing radio industry has successfully blocked the arrival of new "low-power" FM stations.[55]

The evolutionary economic literature provides particular insight into this problem with its distinction between "sustaining" and "disruptive" innovations.[56] Those in the first category simply make a present business model more efficient, like an automatic transmission for a car or a record player that plays music more clearly. Disruptive innovations, conversely, threaten the market position of firms reliant on existing technology. The car did not improve but replaced the horse and buggy, and as our Japanese friends found out, the personal computer did not merely complement the mainframe, but ultimately replaced it. In such cases, broad licensing might be socially efficient but also might mean the death of the licens-

the Allocation of Resources for Invention, *in* 5 Collected Papers of Kenneth J. Arrow: Production and Capital 104, 114–17 (1985) (concluding that the monopolist's incentive to innovate is less than the inventor in competitive industries).

[52] See Wu, supra note 27, at 292–95; Timothy Wu, Network Neutrality, Broadband Discrimination, J. on Telecomm. & High Tech. L. 141, 149–51 (2003) (explaining discrimination in the broadband context).

[53] See Wu, supra note 27, at 292–95.

[54] See id. at 311–24.

[55] See Stuart Minor Benjamin, The Logic of Scarcity: Idle Spectrum as a First Amendment Violation, 52 Duke L.J. 1, 16–17 (2002) ("The campaign against low power FM led Bill Kennard, then Chair of the FCC, to comment sardonically that '[t]he only real interference to Low Power FM radio is from high priced Washington lobbyists.'").

[56] See Clayton M. Christensen & Michael E. Raynor, The Innovator's Solution 34–35 (2003).

ing firm because the firm may have no comparative advantage using the new form of technology. Since few firms plan for their own death, even if their death is in the public interest, the temptation to bury a disruptive innovation may be strong indeed.[57]

The third exception, consistent with our assumptions of human nature, is the effect of pride, laziness, or incompetence. Granted a broad patent or copyright on a popular product, a firm may simply refuse to license decentralized improvement because it wants to retain maximum control and is comfortable with its expected returns. It is, for example, rare to see multiple film versions of a given copyrighted novel, even though one might expect that decentralized competition among films might serve the public interest. On the patent side, the owner of a patented invention may wrongly but proudly believe that he alone possesses the insights to make the best improvements and refuse to license decentralized improvement on that basis. This is reportedly the stance taken by the Wright Brothers, patent holders on several crucial inventions related to the airplane. As Professors Nelson and Merges put it:

> [T]he Wright brothers were very interested in producing aircraft and in improving their design, and they did so actively. However, there were other important people and companies who wanted to enter the aircraft design and manufacture business. They had their own ideas about how to advance the design of aircraft, and they strongly resisted being blocked by the Wright patent.[58]

Human error, in short, is not the exception but the rule, and its absence in licensing practice would be surprising. The more general point is this: Where licensing is possible, the effects of a grant of rights may be hard to predict, as it depends on a rights holder's attitude toward decentralized improvement. Conversely, the effects of non-assignment are more predictable. This point is developed in the remainder of this Essay.

[57] Id.
[58] Merges & Nelson, supra note 9, at 890.

III. A HAYEKIAN APPROACH TO INTELLECTUAL PROPERTY

The Essay so far has sought to establish that decisions related to assignment of intellectual property rights can help centralize or decentralize decisionmaking relevant to intellectual property dependent products. But what can this analysis can tell us about intellectual property policy in general?

This final Part discusses three areas where the approach of this Essay might make an impact on intellectual property questions.

A. Subject Matter

The government is often faced with decisions as to whether intellectual property should exist at all, either for an industry or for a type of product or invention. With the arrival of every new industry—automobiles, airplanes, software, computers, internet auctions—there is always some question as to whether or when intellectual property rights of some form should attach. Over the last several decades, for example, the patentability of software, living creatures, and business methods has been controversial.[59] The analysis here shows that these problems can be reframed as a choice about the decision architecture for the industry in question.

Consistent with the Hayekian analysis used here, the presumption should run against assigning intellectual property rights in new industries. The reason is decisional: Decentralized industry structures seem to have the strongest track record for inculcating innovation and economic growth. The absence of intellectual property rights, absent additional significant barriers to market entry, should yield the default result of a decentralized decision architecture.

The giant exception to this presumption is where the industry in question faces serious prospects of asset misappropriation that will deter investment. Drawing investment into an industry that could not exist absent protection is the strongest

[59] See Robert P. Merges, As Many as Six Impossible Patents Before Breakfast: Property Rights for Business Concepts and Patent System Reform, 14 Berkeley Tech. L.J. 577, 581–84 (1999) (discussing the evolution of patent's subject matter coverage).

reason to grant intellectual property rights. But absent evidence of such a problem, the analysis here suggests that the assignment of intellectual property rights will hinder, rather than foster, optimal product development and consequently economic growth.

Two examples illustrate this reasoning. Business-method patents were first authorized by the Federal Circuit in 1998.[60] The court decided that the inventor of a new method of business could obtain a patent just like any other inventor. A major consequence of business-method patents, if widespread, is decisional in nature. They can flip the basic decentralized nature of deciding how to run a business and improve it in a given industry. For example, if Federal Express were awarded a patent on its (once innovative) overnight delivery business method, it would become a centralized decision maker as to the future of overnight delivery services. It is true that having a single courier company eliminates some errors and duplication of resources, but this comes at the cost of suppressing new ideas for improving the overnight courier method. This cost, moreover, often will be unjustified by any particular danger that the danger of misappropriation will destroy the industry absent government protection.

A second example is broadcast spectrum reform, which has been under consideration for about a decade in the United States. The question is whether broadcasting at certain frequencies should be propertized. In other words, the question is whether some firm should own the alienable rights to broadcast between frequencies *X* and *Y*. The impact of the government's decision whether to grant property rights or not will have important decisional consequences. Granting no rights will create decentralized market entry for spectrum-dependent projects or technologies.[61] Any entity willing to make the investment may develop a project that depends on access to spectrum, albeit at the cost of many failed projects. Granting government-specified licenses or property rights, conversely,

[60] See State St. Bank & Trust. v. Signature Fin. Group, 149 F.3d 1368, 1375–77 (Fed. Cir. 1998).

[61] In a centralized economy, the default option is a hierarchy—that is, a decision by a government planner.

makes some kind of hierarchical decision structure possible in the first place. That is, we should expect to see greater screening of spectrum-dependent projects or technologies before they are launched.

Which is better is slightly ambigious. For some uses of spectrum there may be good arguments for a hierarchical, centralized authority who decides what the spectrum will be used for, perhaps to ensure public safety. But otherwise, whether we want propertized spectrum depends on whether there is any argument that spectrum-dependent projects be carefully screened. Absent risk the public, the answer must sometimes be no.

This, of course, cannot be the end of the analysis. But the insights about the strength of decentralized decisionmaking should at least make policy makers think carefully before assigning rights that might distort the market.

B. Exceptions

The study of decision architectures gives us a new way to understand the relevance of the major exceptions to copyright and patent law. The exceptions have strong decisional consequences. They amount to a governmental decision not to award property rights in a narrow instance and can therefore force a decentralized decision architecture surrounding the exception.

For example, in copyright, the contributory rule of *Sony v. Universal Studios* exempts devices with "substantial noninfringing uses," like VCRs, from liability under copyright.[62] This rule allocates decisionmaking authority over whether a new project that depends on copyrighted works may go forward. In practice, it affects whether a manufacturer like Sony or TiVo may design products independent of the film industry's ap-

[62] Sony Corp. of America v. Universal City Studios, 464 U.S. 417, 441–42, 456 (1984). The Supreme Court reconsidered and revised this rule in *MGM Studios v. Grokster*, 125 S. Ct. 2764, 2770 (2005), holding that one who distributes a device for the purpose of promoting its use to infringe copyright is liable for resulting acts of infringement by third parties using the device, despite the device's lawful uses.

proval, or whether it must ultimately turn to a centralized industry for permission.[63]

A second example is the allowance of "improvement" patents in patent law. Courts have generally allowed later-in-time inventors to receive patents based on significant improvements to an existing invention.[64] Thomas Edison's light bulb, for example, was not the original invention that is sometimes depicted. It was, instead, a significant improvement on previous light bulbs that did not last very long.[65] The allowance of patents on improvements has the result of decentralizing decisionmaking relevant to an initial invention. Though the initial patentee still will own the pioneering invention, it will not automatically own subsequent patents on all related inventions.[66]

A third example is the exception for parody in copyright's fair use doctrine.[67] Under U.S. copyright law, parodies of a work may be produced without the permission of the owner.[68] One effect of this doctrine is decisional. Within the industry, this allows parodists to decide independently whether they want to invest in a parody project. The existence of the exception may reflect an intuition that the original author will make poor assessments of the quality of works intended to humiliate the author and degrade his work.

This Essay suggests that in construing the breadth of exceptions to intellectual property rules, a primary consideration should be the facilitation of decentralized market entry made possible by the exception. In the example of copyright's fair use doctrine, scholars have long argued that fair use is justified by market failure. As Professor Wendy Gordon put it, fair use is, and should be, employed to permit "uncompensated transfers

[63] See generally Picker, supra note 27 (discussing the application of the *Sony* test for contributory copyright infringement to a variety of digital distribution technologies).

[64] See Lemley, supra note 4, at 1000–13.

[65] See The Incandescent Lamp Patent, 159 U.S. 465, 470–74 (1895).

[66] See Lemley, supra note 4, at 1009–10.

[67] See 17 U.S.C. § 107 (2000).

[68] See Campbell v. Acuff-Rose Music, 510 U.S. 569 (1994) (authorizing a parody of the song "Pretty Woman").

that are socially desirable but not capable of effectuation through the market."[69]

While an important insight, what this should mean has never been exactly clear, and we might restate the point slightly. The analysis here suggests that copyright and patent exceptions have a particular urgency when they can open markets to decentralized improvement without permitting misappropriation of the primary owners' investments. That may not be the only reason for calling usage "fair," but from this Essay's perspective, it is the most important. In addition to the parody exception just discussed, this analysis also supports the reverse engineering decisions, which prevent a copyright holder from using copyright to block prospective improvers of software.[70]

Conversely, the analysis here deepens the suspicion that the economic (though not moral) case for copyright's derivative work doctrine is weak. In copyright, the fair use doctrine and derivative work doctrine operate like twin sisters, respectively opening and closing markets to decentralized improvement.

To take one example, copyright places the right to control the development of films based on a novel in the hands of a copyright owner. Why the right should be so allocated has never been well explained in economic terms, although I grant that such rights serve the moral rights of authors. From a market perspective, the adaptation right blocks what would otherwise be a competitive market in films based on a given novel or underlying work.

As a derivative work doctrine is not necessary to prevent primary misappropriation of the copyright work,[71] the eco-

[69] Wendy J. Gordon, Fair Use as Market Failure: A Structural and Economic Analysis of the *Betamax* Case and its Predecessors, 82 Colum. L. Rev. 1600, 1601 (1982).

[70] See Sega Enters. v. Accolade, Inc. 977 F.2d 1510 (9th Cir. 1992) (upholding reverse engineering of a copyrighted computer program for the purposes of study as constituting fair use).

[71] An argument can be made that the adaption right serves the interest of the industry as a whole, and therefore, ultimately, the author. However this is not clear, for the absence of the adaptation right would help some parts of the entertainment industry and hurt other parts. It is not clear that in the aggregate that entertainment industries would be smaller absent an adaption right.

nomic defenses of adaptation rights have relied primarily on preventing either races or redundant creation of works.[72] For example, some argue that if films based on novels were open to any market entrant, races to bring films to market may result. Similarly, others argue that an oversupply of derivative works might lead to redundancy and "rent dissipation."[73] What these arguments overlook is the fact that races and redundancy are a normal feature of a decentralized market. As we said, two gas stations on a single street corner are in a sense redundant, but the alternative of a single, national gasoline station system is unattractive. Similarly, a decentralized market process is full of races. When minivans became popular, car companies raced to bring minivans to market. When kung fu becomes popular, studios dash to produce martial arts films. Rarely do we think government intervention is needed to prevent such behavior.

C. Dead Industries

A final insight generated by the analysis here relates to "dead industries" or stagnant industries where technological development appears stalled or nonexistent. Perhaps surprisingly, there are better arguments for assigning new intellectual property rights for such industries than in dynamic or growing industries.

The reasoning is simple: In a dead industry, the dangers of distorting a decentralized process of product development are minimal. In addition, if profit margins by definition are thin in a declining industry, it will be better to have only the very best projects come to market. [74] (Stated otherwise, Type II errors may have disastrous consequences.)

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[72] See William M. Landes & Richard A. Posner, An Economic Analysis of Copyright Law, 18 J. Legal Stud. 325, 349 (1989).

[73] See Michael Abramowicz, Copyright Redundancy, 9 (Geo. Mason L. & Econ. Res., Paper No. 03-03, 2003), available at http://ssrn.com/abstract_id=374580.

[74] This is similar to Professor Michael Abramowicz's argument for strong rights in copyright in general: prevention of "redundancy." Michael Abramowicz, An Industrial Organization Approach to Copyright Law, 46 Wm. & Mary L. Rev. 33, 72–75 (2004). I think, however, that Abramowicz is correct only in the declining market context.

The incentive and deadweight loss effects of intellectual property grants affects this analysis by fortifying the conclusion just reached. As Justice Stephen Breyer and others have pointed out, the need to provide incentives for product investments depends strongly on the availability of returns from the market.[75] The stronger the market returns, the less government encouragement in the form of intellectual property rights is needed. In a rapidly expanding industry, firms already have strong incentives to bring a new product to market through market returns and the advantages of being a first mover. Meanwhile, the costs of an overly centralized decisionmaking structure are greater. As a result, the desirability of intellectual property rights is at its nadir. In a dead industry, the signs are reversed. The returns from the market are weak, so government may need to provide incentives to encourage any investment in product development at all. The case for strong intellectual property rights is at its zenith.

This analysis of dead industries ignores an important point— namely, that the industry may be dead not for independent reasons, but because of too many barriers to entry, governmental or otherwise. In such a case, adding more rights to the picture is unlikely to have the effects just discussed.

CONCLUSION

Of then-contemporary economic theory, Fredrick Hayek wrote that "there is something fundamentally wrong with an approach which habitually disregards an essential part of the phenomena with which we have to deal: the unavoidable imperfection of man's knowledge and the consequent need for a process by which knowledge is constantly communicated and acquired."[76] Much of the economic reasoning surrounding the grant of intellectual property rights has suffered from the problem Hayek describes. It is implicitly or explicitly based on unrealistic ideas of how firms and industries make important

[75] Stephen Breyer, The Uneasy Case for Copyright: A Study of Copyright in Books, Photocopies, and Computer Programs, 84 Harv. L. Rev. 281, 309–13 (1970).

[76] Hayek, supra note 1, at 530.

licensing, innovation and product development decisions. The importance of understanding this problem cannot be overstated. Intellectual property assignments have become a central tool of economic policymaking in the twenty-first century, administered across industries like a kind of performance-enhancing medicine. And as with medicine, a complete understanding of both the positive and negative effects of such assignments is critical to the design of a rational economic order.