**Property as Process:**
**How Innovation Markets Select Innovation Regimes**
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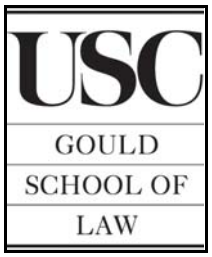


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# Property as Process: How Innovation Markets Select Innovation Regimes

**ABSTRACT.** It is commonly asserted that innovation markets suffer from excessive intellectual property protections, which in turn stifle output. But empirical inquiries can neither confirm nor deny this assertion. Under the agnostic assumption that we cannot assess directly whether intellectual property coverage is excessive, an alternative query is proposed: can the market assess if any "propertization outcome" is excessive and then undertake actions to correct it? This process-based approach takes the view that innovator populations make rent-seeking investments that continuously select among innovation regimes that trade off securing innovation gains (which tends to demand more property) against reducing transaction costs and associated innovation losses (which tends to demand less). If we can identify the conditions under which privately interested investments in lobbying, enforcement, and transactional arrangements are likely to yield socially interested propertization outcomes, then the underlying datum at issue—whether there is "too much" intellectual property—can be determined indirectly at some reasonable degree of approximation. This approach identifies a "property trap" effect where, under high coordination costs, the regime selection mechanism is prone to fail: litigation risk and associated transaction cost burdens drive innovators to overconsume state-provided property rights. Conversely, under low coordination costs, the regime selection mechanism is prone to succeed: adversely affected entities that rely substantially on outside sources for innovation inputs have incentives to undertake actions that weaken property-rights coverage, including constrained enforcement, forming cooperative arrangements, or even forfeiting intellectual property to the public domain. Counterintuitively, these relationships imply that large firms that rely substantially on outside sources for innovation inputs tend to have the strongest incentives and capacities to take actions that correct overpropertization outcomes. Preliminary evidence is drawn from the semiconductor, financial services, and information technology industries.

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## ARTICLE CONTENTS

## INTRODUCTION

> If we did not have a patent system, it would be irresponsible, on the basis of our present knowledge of its economic consequences, to recommend instituting one. But since we have had a patent system for a long time, it would be irresponsible, on the basis of our present knowledge, to recommend abolishing it.[1]

In 1958, in the midst of public debate over the patent system, economist Fritz Machlup delivered the above "non-opinion" to a Senate subcommittee, disclaiming any definitive knowledge concerning whether or not the patent system is a socially desirable institution. Just over fifty years later, a similar public debate over the intellectual property system proceeds in the Supreme Court, which has taken a renewed interest in patent jurisprudence; Congress, which has been deliberating substantial reforms to the patent statutes; and other policymaking, judicial, and scholarly venues. While we certainly have a considerably improved theoretical and empirical understanding on localized points of interest, it is probably uncontroversial among most economically informed observers that Machlup's qualified statement still characterizes our current understanding of the net social value of the intellectual property system as a general matter.[2] Despite this indeterminacy, contemporary legal and

1. FRITZ MACHLUP, SUBCOMM. ON PATENTS, TRADEMARKS, AND COPYRIGHTS OF THE S. COMM. ON THE JUDICIARY, 85TH CONG., AN ECONOMIC REVIEW OF THE PATENT SYSTEM 80 (Comm. Print 1958) [hereinafter ECONOMIC REVIEW]. Several years later, Fritz Machlup, the author of the subcommittee study, expressed a similar remark: "The absence of any empirical evidence for either the claim or its denial that the patent system is an effective promoter of inventive research . . . is most frustrating." FRITZ MACHLUP, THE PRODUCTION AND DISTRIBUTION OF KNOWLEDGE IN THE UNITED STATES 176 (1962).

2. *See, e.g.*, WILLIAM M. LANDES & RICHARD A. POSNER, THE ECONOMIC STRUCTURE OF INTELLECTUAL PROPERTY LAW 10 (2003) (noting "the degree to which economic analysis of intellectual property remains inconclusive, if not indeterminate"); Frank H. Easterbrook, *Who Decides the Extent of Rights in Intellectual Property?*, *in* EXPANDING THE BOUNDARIES OF INTELLECTUAL PROPERTY: INNOVATION POLICY FOR THE KNOWLEDGE SOCIETY 405, 405-06 (Rochelle Cooper Dreyfuss, Diane Leenheer Zimmerman & Harry First eds., 2001) (stating that "we know so little about the effects of our current intellectual property regime on the production and use of traditional intellectual property that it is silly to suppose that we have the information essential to prescribe new regimes for new kinds of intellectual property" and that "[t]he best academic students of the subject disclaim knowledge" as to the optimal strength of intellectual property protection); Adam B. Jaffe, *The U.S. Patent System in Transition: Policy Innovation and the Innovation Process*, 29 RES. POL'Y 531, 531 (2000) (stating that "robust conclusions regarding the empirical consequences for technological innovation of changes in patent policy are few"); Julia D. Mahoney, *Lawrence Lessig's Dystopian Vision*, 90 VA. L. REV. 2305, 2332-33 (2004) (book review) (noting that "it is impossible to state with

scholarly commentary widely asserts that intellectual property coverage has expanded excessively, especially in recently propertized markets that lie at the heart of a knowledge-based economy: business and financial methods, software, semiconductors, and biotechnology.[3] This often-dramatic commentary—which I refer to globally as the "too much property" thesis—warns that a formerly unfettered exchange of ideas has been stifled by a thicket of intellectual property that on the whole impedes, rather than facilitates, technological progress or artistic creativity. But empirics have yet to track rhetoric: the too much property thesis has yet to be supported or denied by definitive evidence[4] and, more generally, stands in uncomfortable contrast with the continuing innovative vigor of the markets where intellectual property thickets are usually claimed to be most intense.

In this Article, I take this empirical uncertainty as an analytical given. I start from the agnostic assumption that we do not have sufficiently reliable information or sufficiently sensitive tools to ascertain whether there is excessive intellectual property protection in any innovation market[5] at any given time. Contrary to the normative mode of most intellectual property scholarship, I therefore maintain strict neutrality throughout as to the socially desirable level of effective property rights coverage—what I call the "propertization outcome"—in any field of technological or cultural innovation. Explicit and consistent recognition of our limited knowledge opens the door to an alternative line of inquiry. In place of the "substance" question as to whether or not any given propertization outcome *is* excessive, I ask a "process" question: can the *market* assess if any propertization outcome is excessive and then undertake actions to move toward a socially preferable alternative outcome? Even if we cannot reliably assess whether or not intellectual property coverage in any given market is excessive, it may be possible to arrive at a reasonable approximation of this unknown datum indirectly by assessing whether the conditions under which coverage is effectively determined are likely to yield and tolerate excessive propertization levels. This approximates standard

complete confidence that any [intellectual property] regime strikes . . . the ideal balance" between incentives and access).

3. For references, see *infra* notes 59-60.

4. For more detailed discussion and supporting references, see *infra* note 103.

5. By "innovation market," I mean any market for the distribution of cultural, technological, or other ideational assets. For the most part, empirical support for my thesis is drawn from markets for technology that are covered by patent rights (as well as database markets that are subject to minimal forms of copyright protection and certain semiconductor products that are covered by sui generis forms of protection). However, my thesis is formulated generically and is logically applicable to cultural markets that are covered by copyright. For further discussion, see *infra* note 131.

methodology in antitrust law, where regulators, courts, and scholars indirectly assess claims of anticompetitive conduct by assessing whether conditions exist that would tolerate and preserve inefficient pricing, rather than assessing whether existing pricing *is* inefficient.[6] So too intellectual property scholars may be able to indirectly assess claims of overpropertization by assessing whether conditions exist that would tolerate and preserve overpropertization outcomes, rather than assessing whether existing propertization outcomes *are* excessive.

To put this process-based approach into operation, I adopt three foundational assumptions. First, I assume that more or less propertization always involves a tradeoff between innovation gains (which require "more IP") and transaction cost losses, including all related social losses in the form of frustrated subsequent innovation (which require "less IP").[7] This implies a simple social cost-benefit test for any propertization outcome: it must yield innovation gains in excess of transaction cost losses. Otherwise, it is excessive consistent with the various formulations of the too much property thesis. Second, in lieu of the top-down approach inherent to legal scholarship where formal actions by the state determine the extant level of intellectual property coverage, I adopt the bottom-up approach of the new institutional economics literature,[8] where private-market investments are the primary factor in eliciting formal issuance of property entitlements. These investments then determine the effective strength of any issued entitlements through adoption and enforcement actions as well as a wide range of transactional arrangements for

6. This approach drives modern economically informed antitrust analysis. For a well-known account, see ROBERT H. BORK, THE ANTITRUST PARADOX: A POLICY AT WAR WITH ITSELF 116-33 (The Free Press 1993) (1978). Note that this "alternative" approach is the standard approach in conventional microeconomic analysis, which generally seeks to demonstrate how competitive markets produce efficient outcomes, in contrast to most law and economics analyses, which generally seek to address whether particular legal rules or doctrines are efficient. *See* Paul H. Rubin, *Judge-Made Law*, *in* 5 ENCYCLOPEDIA OF LAW AND ECONOMICS: THE ECONOMICS OF CRIME AND LITIGATION 543, 544-45 (Boudewijn Bouckaert & Gerrit De Geest eds., 2000).

7. This standard does not exhaustively account for the complex bundle of social gains and losses generated by any extension of intellectual property coverage. However, it is a reasonably close translation of various formulations of the idea that intellectual property coverage is "excessive" and supplies a workable standard by which to isolate the market's ability and incentives to implement propertization outcomes in conformity with the social interest (understood in this limited but meaningful manner). For a precise definition of "transaction cost losses," including subsequent innovation losses, see *infra* notes 52-53 and accompanying text. To avoid any broader efficiency implications, I endeavor throughout to describe "correct" propertization outcomes as "socially compatible," "socially preferred," "socially desirable," or "socially interested." For further discussion, see *infra* note 49.

8. For bibliographic references to this large literature, see *infra* notes 49-50.

exchanging and distributing those entitlements. This methodological turn critically reframes entitlement strength as a moving variable linked to dollar investments by entitlement holders: that is, the strength of any intellectual property entitlement is a continuous function of its formal content plus the expenditures made to fund the costly actions required to implement it. Third, I suppose that these market expenditures then select propertization outcomes that can be situated along a graduated path of innovation regimes, which is bounded by the conventional alternatives of property and commons but comprises in its intermediate region a rich variety of limited-access property regimes—what I refer to globally as "sharing regimes"—where some, but not all, relevant innovation assets are eligible for property rights protection.

This analytical framework supports this Article's primary exercise: to identify the conditions under which privately interested innovator populations likely will, and will not, have the incentives and capacities to undertake lobbying, adoption, enforcement, and other actions that select socially interested points along the regime path, each of which implements some tradeoff between innovation gains and transaction cost losses. Put slightly differently: is the market likely to make a mistake as it selects among innovation regimes and, if so, can we anticipate the direction of any such mistake? To formulate a meaningful response, I focus on stylized movements between two broadly defined regions on the regime path: (i) a *property regime* where innovation assets are substantially protected by property rights and (ii) a *sharing regime* where innovation assets are substantially *un*protected by property rights. This theoretical exercise yields a property trap scenario where the market is inherently likely to get it wrong. The underlying mechanism is straightforward: as a result of negative externalities generated by innovators who exit a sharing regime for a newly introduced property regime, an innovation market is prone to move "too quickly" in abandoning the low transaction cost structure of a sharing regime, resulting in a net social loss consistent with the too much property thesis. Faced with increasing litigation risk from potential infringement claims and increasing input costs from a declining innovation pool, each innovator rationally defects to the property regime even if it would elect otherwise if sufficient coordination could be achieved to control outward migration. This property trap thesis supplies an economic rationale for the widely expressed intuition that there seems to be too much intellectual property. But there is a key difference: the property trap thesis identifies the predicate conditions under which the market is likely to tolerate an excessive propertization outcome and does not *directly* take any view as to whether propertization levels in any particular market *are* excessive. Where those conditions are not satisfied, there is a substantially reduced likelihood that excessive intellectual property coverage would be tolerated by the relevant market, in which case, at some reasonable level of certainty, we can

*indirectly* take the view that existing propertization outcomes are either not excessive or, if excessive, are likely to be cured by market action within some reasonable period of time.

Building in part on established lessons from the public choice literature on the rationally self-interested processes that drive policy outcomes,[9] I argue that markets are likely to resist and correct overpropertization—that is, the property trap is likely to be broken—where two conditions are substantially satisfied. First, it must be the case that adversely affected innovators are neither clearly net users nor clearly net producers of the relevant pool of intellectual goods, which is likely to be true in any market that relies on cumulative innovation—that is, a sequence of related first-mover and *n*-mover innovations—and thereby compels even highly integrated entities to access inputs from outside sources. Firms that tend to stand on both sides of intellectual property transactions—that is, tend to both purchase and sell intellectual goods to a meaningful extent—have a rational interest in an intermediate level of protection that both secures returns on the sale of intellectual outputs and reduces the costs incurred to obtain intellectual inputs in the course of product development. Second, it must be the case that adversely affected innovators enjoy low coordination costs, which is likely to be true where innovators are few in number (or act through a collective organization) and occupy a dominant market position. In small-number blocs that occupy a large portion of the relevant market, each individual firm may expect to derive a sufficient portion of the joint gains generated by collectively beneficial restraints on the adoption and enforcement of intellectual property protections, thereby alleviating the free-rider problem that otherwise results in collective action failure.

These limited but potent capacities for market self-correction yield an important implication that challenges the conventional political economy of intellectual property: concentrated and well-endowed economic interests—normally, the chief alleged culprits behind excessive levels of intellectual property protection—are often most likely to have the strongest incentives and capacities to scale back overextended intellectual property coverage.

This proposition—which runs counter to widely held popular and scholarly views as to the political process by which intellectual property rights are typically determined—is far from a theoretical artifact. Ample empirical evidence illustrates robust self-correction capacities among large-firm incumbents, *precisely* in economically critical innovation markets that both

9. The literature is vast. For a seminal source, see MANCUR OLSON, THE LOGIC OF COLLECTIVE ACTION: PUBLIC GOODS AND THE THEORY OF GROUPS (1965). For a standard current reference, see DENNIS C. MUELLER, PUBLIC CHOICE III (2003).

stand at the heart of our knowledge economy and are presumptively most susceptible to, and widely believed to suffer from, excessive propertization.[10] I identify a wide range of "truncation actions" in the information technology, software, database, financial services, and biotechnology markets, where, contrary to oft-mentioned claims (and theoretical expectations) of runaway transaction costs and suppressed innovative output, incumbent firms have substantially halted or curtailed movements toward enhanced propertization. These actions cover a broad range of activities, including direct influence through lobbying actions or, of greater practical interest, indirect influence through constrained enforcement, patent pools, research consortia, public access databases, and other voluntarily formed sharing arrangements that substantially lower the transaction cost burdens and innovation losses associated with a robust property regime. Most dramatically, these truncation actions include outright forfeitures of intellectual assets to the public domain. Far from being the inveterate enemies of the social interest, the *most* influential holders of intellectual resources often self-interestedly act in substantial conformity with the collective interest in scaling back intellectual property protections so as to limit the transaction cost losses attendant to excessive propertization. An extended case study of the historical evolution of property regimes in the semiconductor market illustrates in detail this cautiously optimistic view: concentrated interests appear to periodically adjust propertization outcomes through cooperative arrangements that alleviate the transaction cost burden imposed by a property rights regime.

The organization of the Article is as follows. In Part I, I construct the conceptual framework for a process-based analysis of propertization outcomes in innovation markets. In Part II, I apply this framework to identify both a "mistake scenario" where the market driven selection mechanism is likely to generate excessive propertization outcomes and a "correction scenario" where adversely affected innovator populations are likely to reverse or mitigate those outcomes. In Part III, I use this theoretical apparatus to develop a generic template for regime selection in innovation markets, which is then applied to generate a customized regime path that traces the historical evolution of innovation regimes in the semiconductor industry.

## I. INTELLECTUAL PROPERTY AS REGIME SELECTION

In this Part, I build the conceptual foundations for this Article's process-based analysis of intellectual property expansion. First, I argue that

10. *See infra* Section II.C.

propertization outcomes are principally a function of private lobbying, adoption, and enforcement expenditures. Second, I provide a simple taxonomy of innovation regimes among which the market selects as it allocates resources to lobbying for, and then adopting and enforcing, state-provided property entitlements. Third, I articulate a constrained social cost-benefit principle that drives market movements along the regime path: namely, innovator populations that satisfy certain predicate characteristics will tend to make regime selections that implement a socially interested tradeoff between innovation gains and transaction cost losses.

### *A. Effective Propertization*

The expansion of intellectual property protections is usually construed in formal terms as a function of legislative, judicial, and agency actions (the relevant agencies being the Patent & Trademark Office (PTO) and the Copyright Office). Consistent with this traditional approach, it is undoubtedly the case—as the "too much property" thesis observes—that the past decades have witnessed a substantial expansion in the subject matter that is formally eligible for protection under the patent and copyright statutes, especially in biotechnology, software, semiconductors, and nontechnical business methods.[11] But there is an important qualification to this common observation: *formally eligible* does not mean *actually used and enforced*. Frequent characterizations of excessive propertization—for example, isolated references to "crazy" patents issued by the PTO—fail to take into account this critical difference between formal enactment and actual adoption and enforcement, thereby easily overstating the effective level of propertization.[12] A merely formal approach can substantially overestimate the effective level of propertization in any innovation market, principally because simple

11. For an extensive historical review of these subject-matter expansions in the patent context, see Robert Greene Sterne & Lawrence B. Bugaisky, *The Expansion of Statutory Subject Matter Under the 1952 Patent Act*, 37 AKRON L. REV. 217 (2004). For further discussion of subject-matter expansion in the case of nontechnical business method patents, see *infra* notes 68-74 and accompanying text; in the case of software, see *infra* note 70; in the case of biotechnology, see *infra* note 56; and in the case of semiconductors, see *infra* notes 158-159 and accompanying text.

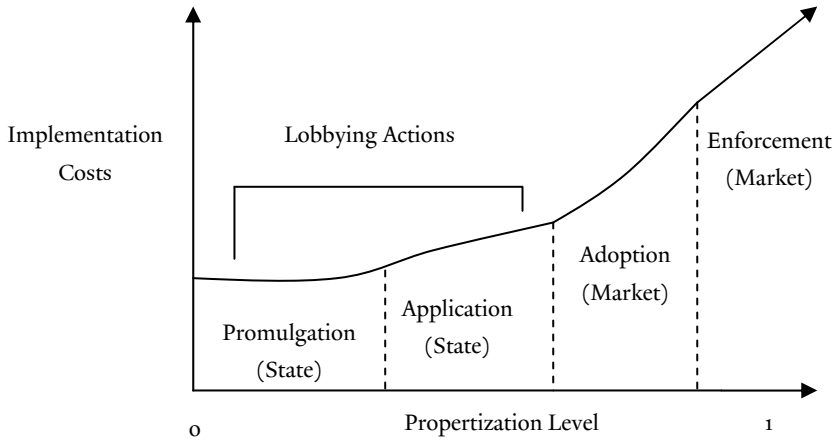
12. For similar thoughts, see Mark A. Lemley, *Ignoring Patents*, 2008 MICH. ST. L. REV. 19 (2008); Robert P. Merges, *The Uninvited Guest: Patents on Wall Street*, ECON. REV., Fourth Quarter 2003, at 1, 6-7.

promulgation through legislative, judicial, or agency action is only the first and, almost certainly, least costly step in the propertization process.[13]

As depicted below in Figure 1 (using hypothetical values), throughout I view any propertization outcome as the aggregate result of four implementation actions, progressively increasing in cost as a general matter: (i) formal promulgation of the relevant entitlement by legislative, judicial, or agency action; (ii) interpretation and application of the relevant entitlement by courts and issuing agencies; (iii) registration, notice, deposit, application, and other actions necessary to adopt the relevant entitlement; and (iv) enforcement of the relevant entitlement through monitoring activities, licensing negotiations, and actual or threatened litigation ending in trial or settlement.

13. In particular, Figure 1 does not capture: (i) increases in the length of copyright and patent terms; (ii) increases (or decreases) in the ease of showing eligibility when applying for the relevant entitlement and infringement when bringing suit, especially relevant in the patent context; and (iii) increases (or decreases) in the typical range of damages awards and the availability of injunctive remedies. For a semiformalized attempt to measure propertization against a broader set of relevant factors, see R.E. Evenson & Jonathan D. Putnam, *Institutional Change in Intellectual Property Rights*, 69 AM. J. AGRIC. ECON. 403 (1987). For a qualitative discussion that describes multiple factors that can subject intellectual goods to a property rights regime, see Michael A. Carrier, *Cabining Intellectual Property Through a Property Paradigm*, 54 DUKE L.J. 1, 18-25 (2004).

**Figure 1.**
**IMPLEMENTATION**[14]




Subject to the inherent distortions of "political noise" in the supply of intellectual property protections, all these implementation actions are entirely or substantially undertaken through, or in response to, resource expenditures by innovators or other affected populations. Formal extensions and subsequent applications by the state (including, in the patent context, field-specific examination criteria released periodically by the PTO) are undertaken in response to lobbying expenditures while adoption and enforcement actions are taken directly and demand substantial out-of-pocket expenditures by entitlement holders.[15] An emphasis on the determinative role of private

14. The horizontal axis is "normalized" so that "0" designates zero propertization and "1" designates complete propertization. Note that this Figure is simplified to the extent that: (i) lobbying activities are confined to the promulgation and application stages, which will be a simplification in some cases where the legislature, agencies, or courts contemplate modifications to previously promulgated entitlements; and (ii) the application of promulgated entitlements by the courts or relevant agencies may sometimes lower propertization levels or, alternatively, may be collapsed into the adoption and/or enforcement rubrics.

15. Some enforcement and administrative expenditures are made by government agencies (which in turn can be construed as a function of lobbying by entitlement holders). As a practical matter, however, (i) "out-of-pocket" administrative costs are negligible since the PTO is now fully "self-funded" and the Copyright Office is partially "self-funded" by filing and other fees; and (ii) government enforcement expenditures fall well short of private expenditures (and can therefore be safely omitted for analytical convenience). For a review of federal enforcement of criminal statutes against counterfeiting and other intellectual

influence on public laws is hardly foreign to intellectual property scholarship, which has closely documented that patent and copyright legislation is heavily guided and sometimes even negotiated by industry representatives, up to and including drafting of statutes and even congressional committee reports.[16] But legislative action is at best half the story. Once promulgation by the courts or legislature and robust application by the courts and/or agencies is achieved, the implementation process cannot be completed without substantial and continuing expenditures to support adoption and enforcement.[17] This is neither an easy nor an inexpensive task given the intrinsically high definition and exclusion costs that characterize intangible assets, which in turn require investments in adoption and enforcement activities to an extent not typically necessary in tangible-good contexts. To protect its creative or technological assets by recourse to legal entitlements, a firm must make substantial expenditures to establish an internal administrative apparatus, hire or retain legal counsel, prepare application and registration documents and pursue relevant actions with the issuing agency, monitor intellectual property generation within the relevant organization, detect infringements by third parties, and take legal action against identified infringers.

These mundane activities are critical: without sufficient investments in adoption and enforcement, the underlying formal entitlement will wane in importance, resulting in a vestigial entitlement that has little practical effect.[18] Available data from the patent context show the impressive magnitude of these

property crimes, see U.S. DEP'T OF JUSTICE, PROGRESS REPORT OF THE DEPARTMENT OF JUSTICE'S TASK FORCE ON INTELLECTUAL PROPERTY (2006), http://www.usdoj.gov/opa/documents/ipreport61906.pdf.

16. *See* Robert P. Merges, *Intellectual Property Rights and the New Institutional Economics*, 53 VAND. L. REV. 1857, 1875 (2000) [hereinafter Merges, *Intellectual Property Rights*]; Robert P. Merges, *One Hundred Years of Solicitude: Intellectual Property Law, 1900-2000*, 88 CAL. L. REV. 2187, 2200-01 (2000). On the extensive involvement of industry representatives in the drafting and negotiation of copyright legislation, see Jessica D. Litman, *Copyright, Compromise and Legislative History*, 72 CORNELL L. REV. 857 (1987); and Jessica D. Litman, *Copyright Legislation and Technological Change*, 68 OR. L. REV. 275, 276-78 (1989).

17. See *infra* notes 19-24 and accompanying text.

18. The reverse is also possible: a weak level of formal intellectual property protection may effectively be enhanced through aggressive enforcement actions by entitlement holders. Several scholars have recently pursued variations of this scenario in the copyright context, arguing that aggressive threats of infringement litigation against cash-poor and/or risk-averse firms or individuals can lead to licensing practices that effectively extend the scope of the corresponding intellectual property entitlement and are sometimes subsequently entrenched through judicial decisions. *See* Thomas F. Cotter, *Fair Use and Copyright Overenforcement*, 93 IOWA L. Rev. 1271 (2008); James Gibson, *Risk Aversion and Rights Accretion in Intellectual Property Law*, 116 YALE L.J. 882 (2007); Jennifer E. Rothman, *The Questionable Use of Custom in Intellectual Property*, 93 VA. L. REV. 1899 (2007).

required expenditures, both individually and in the aggregate. While available estimates vary, it is agreed that aggregate application and litigation expenditures run into several *billions* of dollars annually,[19] which, given relatively meager government expenditures on enforcement actions,[20] constitute the lion's share of total social resources allocated to implementation of the patent system. A partial measure of adoption costs can be obtained simply by reference to the filing, maintenance, and other fees paid to the PTO in fiscal year 2008 and the Copyright Office in fiscal year 2007, which amount to $1.625 billion and $24.7 million respectively.[21] Both figures omit the substantially larger fees paid to attorneys and other specialists during the application process. Available estimates of PTO fees plus legal fees are roughly $20,000 per patent, which still covers only a minority of a fully maintained patent's lifetime cost, including renewal fees,[22] costs relating to PTO appeals and interference proceedings, and/or costs relating to foreign patent applications.[23] Even if a firm rationally incurs adoption (and subsequent renewal) costs, fears of runaway litigation costs may then drive it rationally to forego expenditures on subsequent enforcement, thereby entirely or partially

19. On adoption and enforcement costs, see Mark A. Lemley, *Rational Ignorance at the Patent Office,* 95 Nw. U. L. REV. 1495, 1498-1502 (2001), which estimates $4.33 billion for annual patent prosecution costs and $2.1 billion for annual litigation costs. On enforcement costs, see Josh Lerner, *Patenting in the Shadow of Competitors*, 38 J.L. & ECON. 463, 470 (1995), which estimates that patent litigation begun in 1991 will generate total legal expenditures of approximately $1 billion.

20. *See supra* note 15.

21. U.S. COPYRIGHT OFFICE, ANNUAL REPORT OF THE REGISTER OF COPYRIGHTS: FISCAL YEAR ENDING SEPTEMBER 30, 2007 (2007) http://www.copyright.gov/reports/annual/2007/ar2007.pdf; U.S. PATENT & TRADEMARK OFFICE, PERFORMANCE AND ACCOUNTABILITY REPORT FISCAL YEAR 2008, at 56 (2008) http://www.uspto.gov/web/offices/com/annual/2008/2008annualreport.pdf. For the PTO, immediately prior years show slightly lower figures: $1.507 billion in 2007, $1.384 billion in 2006, and $1.198 billion in 2005. U.S. PATENT & TRADEMARK OFFICE, *supra*, at 56.

22. Renewal fees are due at three and a half, seven and a half, and eleven and a half years after patent issuance. *See* 35 U.S.C. § 41(b) (2000).

23. *See* Lemley, *supra* note 19, at 1498-99 (estimating $10,000-$30,000 as the cost of a typical patent application, including legal fees, but excluding subsequent renewal fees); Jonathan S. Masur, *Costly Screens and Valuation Asymmetries* 20 (Univ. of Chicago Law & Economics, Olin Working Paper No. 393, 2008), http://www.ssrn.com/abstract=1105184 (estimating $22,000 as the cost to prosecute an average patent application, including attorneys' fees, but excluding subsequent renewal fees). Obtaining patent protection in other jurisdictions adds substantial additional costs, potentially exceeding $100,000 (depending on the number of jurisdictions). U.S. GEN. ACCOUNTING OFFICE, INTERNATIONAL TRADE: FEDERAL ACTION NEEDED TO HELP SMALL BUSINESSES ADDRESS FOREIGN PATENT CHALLENGES, GAO-02-789, at 10 (2002).

releasing the relevant asset into the public domain. These fears are well founded: the most recent estimates show that median patent discovery and litigation costs are $2.5 million and $4 million respectively in the case of litigations involving (as is typical) claimed damages in excess of $25 million,[24] which rival corresponding costs in other fields of civil litigation.[25]

The big picture is clear: any robust level of intellectual property protection is dependent on (i) one-time (or, in some cases, a series of) fixed-cost lobbying expenditures to generate the initial set of legal entitlements, followed by (ii) continuing variable-cost expenditures of several billions of dollars annually by entitlement holders, who consume legal entitlements as determined by marginal private cost-benefit valuations. So long as we allow for the possibility that marginal expected costs may sometimes run ahead of the marginal expected benefits of property rights coverage, it follows that a firm's *actual* consumption of intellectual property rights—specifically, its decision whether to adopt and then enforce an intellectual property entitlement—must sometimes fall below a firm's *theoretically* available levels of intellectual property rights as a matter of formal law. As I describe immediately below, indicative data in the patent context suggest that the gap between *actual* and *theoretically possible* consumption levels is substantial, which means in the aggregate that a substantial percentage of all patent-eligible intellectual goods—even goods that are eligible for formally robust protections—are regularly given over to the public domain or, at least, are not protected to the maximum extent afforded by the underlying set of legal entitlements. This is functionally equivalent to a real property regime where, given high administration and enforcement costs, most potential entitlement holders fail to defend title, leaving it up for grabs to third parties who may seize it by force or simple occupancy.

A brief exercise to quantify this gap between actually implemented and theoretically available protection levels in the patent sector is enlightening. The Figure below depicts a reasonable estimate of the relative distribution of patentable assets among (i) unpatented; (ii) patented; (iii) patented and renewed beyond "mid-term"; and (iv) patented, renewed (beyond mid-term) and licensed or enforced assets. Understandably, there are no precise data on the percentage of patentable assets that are not actually patented (region *A*

24. U.S. FED. TRADE COMM'N, TO PROMOTE INNOVATION: THE PROPER BALANCE OF COMPETITION AND PATENT LAW AND POLICY 3 n.11 (2003) (citing AM. INTELLECTUAL PROPERTY LAW ASS'N, REPORT OF THE ECONOMIC SURVEY 2003, at 22 (2003)), http://www.ftc.gov/opa/2003/10/cpreport.shtm.

25. *See* James Bessen & Michael J. Meurer, *Lessons for Patent Policy from Empirical Research on Patent Litigation*, 9 LEWIS & CLARK L. REV. 1, 25 (2005).

makes what must be a very conservative estimate of roughly eighty percent). However, there are data on renewal rates: in jurisdictions with periodic renewal requirements (the United States, for example), recent data show that approximately *fifty percent* of all patents lapse due to failure to pay renewal fees through the mid-point[26] of the twenty-year statutory term[27] (region *B*) and, in European jurisdictions with annual renewal requirements, older data show that approximately *ninety-five percent* of all patents lapse due to failure to pay renewal fees sometime prior to the end of the statutory term (not shown).[28] Hence, even if we make the more conservative assumption that *all* patent-eligible assets are patented, then patent protection on over half of those assets lapses by the middle of the term, and virtually all protection lapses sometime prior to the end of the term. Given exorbitant legal fees relating to infringement litigation and substantial fees relating to licensing negotiations, it is reasonable to assume that a significant portion of the remainder pool of even *renewed* patents lapse because entitlement holders decline to incur some or all of these costs, either by declining enforcement or by accepting a below-market settlement offer (region *C*).[29] It therefore follows that substantially implemented patent protection beyond the mid-term point (region *D*) is almost certainly an *exception*, not the norm, within the total pool of patent-eligible intellectual goods. *Fully* implemented patent protection through the end of the term (not shown) is close to a negligible minority of the total pool of patent-eligible goods, in which case the effective term and scope of patent

**26.** To be precise, the final maintenance fee payment is due eleven and a half years after issuance of the patent. *See* 35 U.S.C. § 41(b) (2000). Fees are $4,110 or, in the case of a "small entity," $2,055. *See* U.S. PATENT & TRADEMARK OFFICE, FY 2009 FEE SCHEDULE (2009), http://www.uspto.gov/web/offices/ac/qs/ope/fee2009january01_2009may01.htm#partapp.

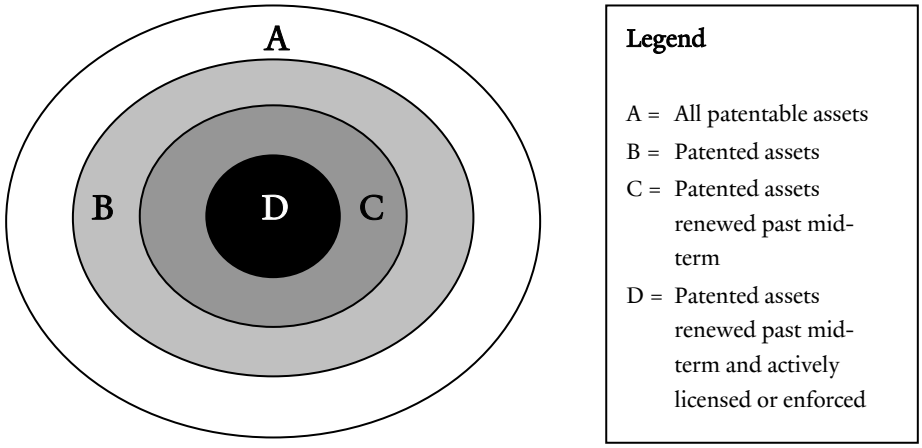
**27.** *See* Kimberly A. Moore, *Worthless Patents*, 20 BERKELEY TECH. L.J. 1521, 1526 (2005) (finding that 53.71% of U.S. patentees that issued patents in 1991 allowed the patents to expire for failure to pay maintenance fees sometime prior to twelve years after issuance).

**28.** P.J. FEDERICO, RENEWAL FEES AND OTHER PATENT FEES IN FOREIGN COUNTRIES, STUDY OF THE SUBCOMMITTEE ON PATENTS, TRADEMARKS, AND COPYRIGHTS OF THE COMMITTEE ON THE JUDICIARY, U.S. SENATE, 85th Cong., at 27, 29-30 (2d Sess. 1958) (showing, for the period 1930-1939, the following renewal rates for the following countries in the following years: Great Britain (year 16, 5%), Germany (year 18, 2.2%), Sweden (year 17, 4.6%), France (year 20, 2.9%) and the Netherlands (year 18, 2.2%)).

**29.** It appears that only a small percentage of all issued patents are licensed, and even fewer are litigated. *See* Lemley, *supra* note 19, at 1507 (estimating that only about five percent of issued patents are licensed for a royalty, not including cross-licenses). While not based on hard data, Lemley's conjecture is consistent with other data that imply an extremely skewed distribution of patent values. *See* F.M. Scherer & Dietmar Harhoff, *Technology Policy for a World of Skew-Distributed Outcomes*, 29 RES. POL'Y 559, 560 tbl.1 (2000).

protection are drastically smaller than would appear to be the case based on the formal law.

**Figure 2.**
THE "IP EXCEPTION" (PATENTS)[30]




This disjuncture between formal law and effective law reaches its apex in the case of entire intellectual property statutes that are mostly form and little substance (meaning that the combined size of regions *B* + *C* + *D* is *nominal* in these cases). This category includes multiple sui generis entitlements that are formally available but have generated low application and litigation volumes over the lifetime of the underlying statute. This intellectual property graveyard includes (in varying degrees of rigor mortis): the Design Patent Act,[31] Plant Patent Act,[32] Plant Variety Protection Act,[33] Semiconductor Chip Protection

30. All relative values are hypothetical for expository purposes but, as discussed in the text, based on reasonable assumptions given available data. Increasingly dark coloration indicates increasing propertization, and vice versa. Each region is understood to encompass all regions situated closer to the circle's center (that is: *B* + *C* + *D* is a subset of *A*, *C* + *D* is a subset of *B*, and *D* is a subset of *C*). The Figure is not drawn precisely to scale.

31. 35 U.S.C. §§ 171-173 (2006). The Act provides limited-duration patent protection for useful articles that are otherwise ineligible for protection under the copyright statute. On its limited usage, see William S. Thompson, *U.S. Design Protection: Discussion of Status and Suggested Proposals*, 24 AIPLA Q.J. 393, 394-95, 404-05 (1996).

32. 35 U.S.C. §§ 161-164. The Act provides sui generis protection on asexually reproducing plant varieties. On its limited usage, see Judith I. Stallman & A. Allan Schmid, *Property*

Act,[34] and the Vessel Hull Design Protection Act.[35] These "dead" statutes (that is, underadopted and underlitigated) are the most striking illustrations of the fundamental relationship between private investment and entitlement strength: without sufficient resources continuously allocated to adoption and enforcement actions, even the most potent formal protections lose practical importance.

### *B. Graduated Propertization*

If we adopt the view that the market largely selects propertization outcomes through expenditures on lobbying, adoption, and enforcement actions, then we must identify the set of propertization outcomes (or innovation regimes) among which the market may make its selection. The familiar menu studied by legal and economic scholars typically offers a simple choice between (i) a *property* regime, which is the practical equivalent of complete or substantially complete propertization; and (ii) a *commons*, which is the practical equivalent of zero or nominal propertization. This dichotomy in turn drives the conventional assumption that the high transaction cost burden of a formal property regime is the necessary social price that must be paid in order to preclude the underinnovation outcome that prevails without it. But an extensive empirical literature on informal governance arrangements for common pool resources transcends this binary taxonomy, providing abundant examples where private parties establish and maintain *limited access sharing regimes* that lie at various points in the intermediate region between an *open access commons* and *closed access property regime*. This imposes some limits on unauthorized usage (thereby partially internalizing negative externalities that otherwise result in overconsumption), but without incurring all of the

*Rights in Plants: Implications for Biotechnology Research and Extension*, 69 AM. J. AGRIC. ECON. 432 (1987).

33. 7 U.S.C. §§ 2321-2582. The Act provides sui generis protection on sexually reproducing plant varieties. On its limited usage, see Mark D. Janis & Jay P. Kesan, *U.S. Plant Variety Protection: Sound and Fury . . . ?*, 39 HOUS. L. REV. 727 (2002). Note that certain plant varieties can now be protected under the general patent statute, which has bolstered property rights protections in this market. *See* J.E.M. AG Supply, Inc. v. Pioneer Hi-Bred Int'l, Inc., 534 U.S. 124 (2001).

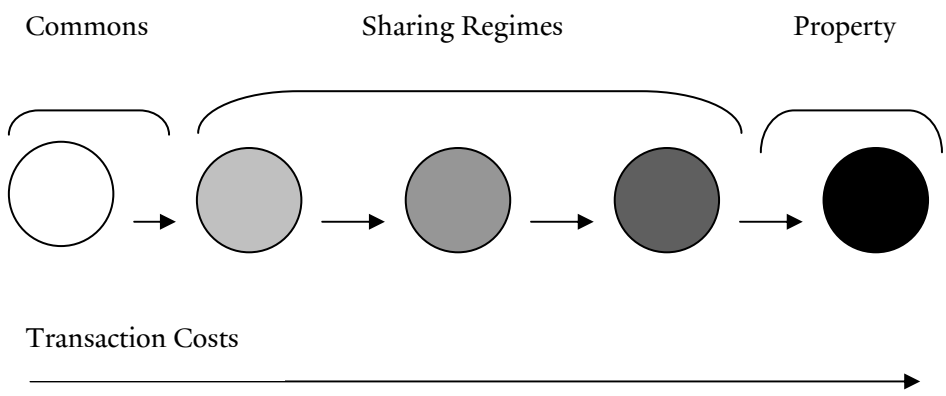
34. 17 U.S.C. §§ 901-914. On its limited usage, see *infra* note 160 and accompanying text.

35. 17 U.S.C. §§ 1301-1332. The Act provides sui generis protection on "moldings," or designs for recreational boat hulls. On its limited usage, see Bradley J. Olson, *The Amendments to the Vessel Hull Design Protection Act of 1998: A New Tool for the Boating Industry*, 38 J. MAR. L. & COM. 177 (2007).

transaction costs of a state-administered property regime.[36] The same is clearly true of innovation markets (which face the converse problem of internalizing positive externalities that otherwise result in *under*investment): not all vigorous innovation markets are protected by any, or any robust, formal intellectual property protections, which (provided we retain the conventional assumption that imitation always depletes returns on innovation) necessarily implies an intermediate case where a remunerative mechanism other than state-provided property rights sustains innovation incentives.

This graduated scheme of propertization outcomes is depicted below: sharing regimes occupy a broad intermediate region of lesser to greater propertization bounded on each side by zero to nominal propertization in the case of a commons regime and complete to near complete propertization in the case of a property regime.

**Figure 3.**
PROPERTIZATION RANGE[37]




36. For the leading source, see ELINOR OSTROM, GOVERNING THE COMMONS: THE EVOLUTION OF INSTITUTIONS FOR COLLECTIVE ACTION (1990).

37. Consistent with the prior Figure, increasingly dark coloration indicates increasing propertization, and vice versa.

As I describe in detail in a companion publication,[38] this intermediate region is occupied both historically and currently by variants of a mixed exclusionary structure that stands between the zero propertization of a commons regime and the full propertization of a property regime. This hybrid regime, explored extensively in the real property context but to a far lesser extent in the intellectual property context,[39] can be described generically as follows. The relevant innovation asset is freely or substantially exposed to imitation, thereby resembling a commons regime that cannot independently generate any remunerative stream for the original innovator, but is bundled with collateral assets that are legally, extralegally, or technologically protected against lower cost imitation, thereby providing an allied exclusionary instrument that in turn generates a remunerative stream to the original innovator.

To provide a concrete illustration, consider the imitation threats faced by a financial services firm that periodically releases new investment products (for simplicity, assume prior to the definitive recognition of business method patents in the Federal Circuit's 1998 *State Street* decision[40]). The conceivable product space covers a broad gamut of financial instruments: debt, equity, or equity-linked securities; call options, put options, and futures contracts; actively or passively managed mutual funds; exchange-traded funds; real estate investment trusts; money management accounts; annuities and other insurance products; and so on. Since any new product is (in our historical

38. *See* Jonathan M. Barnett, *Sharing in the Shadow of Property: Rational Cooperation in Innovation Markets* (Univ. of S. Cal. Law Sch., Law & Econ. Working Paper Series No. 87, 2008). Note that, in the companion piece, I describe both (i) a hypothetical "pure form" sharing regime that relies exclusively on reputation-driven social norms to sustain innovation incentives and (ii) a variety of actual "mixed-form" sharing regimes where a substantial portion of the innovation pool is unprotected by legal barriers but there exist collateral legal and extralegal imitation barriers that protect some other portion of the aggregate product and services bundle. The sharing regime described above corresponds to the latter variety, which has far broader application in economically intensive settings. As I show in the companion piece, the former has virtually none.

39. For contributions that apply a "semicommons" concept to the intellectual property context, see Brett H. Frischmann & Mark A. Lemley, *Spillovers*, 107 COLUM. L. REV. 257 (2007); and Robert A. Heverly, *The Information Semicommons*, 18 BERKELEY TECH. L.J. 1127 (2003). For explorations of mixed property regimes more generally, see Michael A. Heller, *The Dynamic Analytics of Property Law*, 2 THEORETICAL INQUIRIES IN L. 79 (2001); Carol H. Rose, *The Several Futures of Property: Of Cyberspace and Folk Tales, Emission Trades and Ecosystems*, 83 MINN. L. REV. 129 (1998); and Henry E. Smith, *Semicommon Property Rights and Scattering in the Open Fields*, 29 J. LEGAL STUD. 131 (2000).

40. State St. Bank & Trust Co. v. Signature Fin. Group Inc., 149 F.3d 1368 (Fed. Cir. 1998). For further analysis of the decision, see *infra* Section II.A.

setting) ineligible for patent protection[41] and therefore exposed to lower cost imitation by third party competitors, it appears that the bank operates in a commons regime that fails to sustain innovation incentives, given that imitator firms bear none of the development costs and risks borne by an innovator firm. But this conclusion is inaccurate, as evidenced simply by the fact that an abundant number of new securities, accounts, and other investment products *have* been regularly introduced into the market despite being prone to (and actually subject to) widespread imitation.[42] In actuality, the apparent anomaly is easily solved: the bank operates in a sharing regime where (i) the core innovation asset (namely, the investment product) is largely unprotected, either by legal, technological, or extralegal instruments, and therefore is immediately thrown into the collective industry pool, but (ii) the collateral assets *are* substantially protected against third party imitation, either by legal instruments in the case of trademarked brand names (and associated goodwill), contractual rights, or technological characteristics in the case of all other product attributes.[43]

The Figure below depicts the appropriation infrastructure that supports this result: while third party competitors can freely replicate the bank's product innovation (which is therefore forfeited to the collective industry pool), this is not true of the bank's collateral assets—distribution and marketing relationships; production and distribution efficiencies; economies of scale and scope; "learning by doing"; and tacit knowledge[44]—that must be replicated in order to substantially imitate the total bundle of relevant product

41. Prior to the *State Street* decision in 1998, it had been commonly understood that patent protection was unavailable for financial instruments, following the historical bar on patenting abstract ideas and mathematical formulae, which case law had extended to bar business-method patents. *See* Hotel Sec. Checking Co. v. Lorraine Co., 160 F. 467, 469 (2d Cir. 1908).

42. *See* Peter Tufano, *Financial Innovation*, *in* HANDBOOK OF THE ECONOMICS OF FINANCE (George M. Constantinides et al. eds., 2007) (estimating that from 1980-2001, 1200 to 1800 new types of securities were released into the market); *see also* Peter Tufano, *Financial Innovation and First-Mover Advantages*, 25 J. FIN. ECON. 213, 215 (1989) (showing that fifty-eight financial innovations in corporate and mortgage-backed securities were used to raise 11.6% of the dollar volume of all U.S. public offerings during the period 1974-1987) [hereinafter Tufano, *Financial Innovation and First-Mover Advantages*].

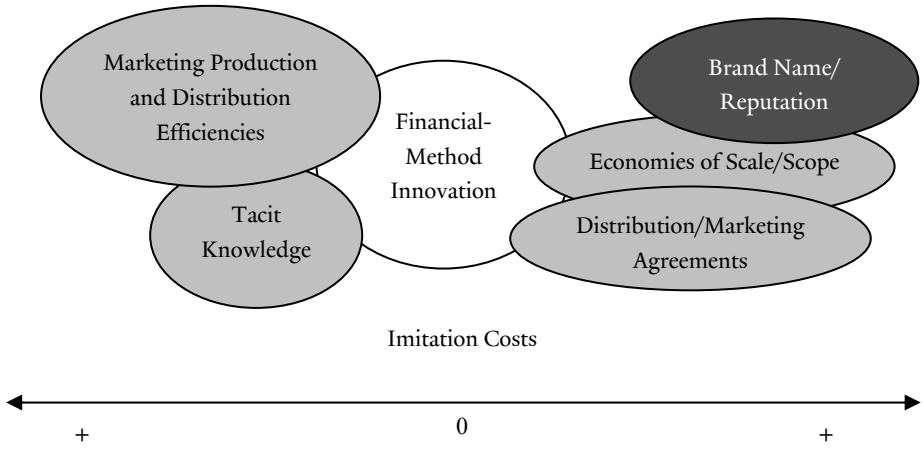
43. Consistent with this view, empirical inquiry has shown that first-mover innovators accrue substantial returns even though successful financial products are subject to imitation. *See* Tufano, *Financial Innovation and First-Mover Advantages*, *supra* note 42, at 230-35. For further discussion of alternative appropriation instruments in the financial market, see Merges, *supra* note 12, at 4-5.

44. For detailed discussion of these alternative appropriation instruments, see Jonathan M. Barnett, *Private Protection of Patentable Goods*, 25 CARDOZO L. REV. 1251, 1257-69 (2004).

characteristics. By bundling the legally unprotected core asset with collateral assets subject to technological, legal, or extralegal protections, the innovator firm can protect substantially against the diversion of economic rents to competitors. The result: even assuming *no* legal protection against imitation of the core innovation asset, the firm can reasonably anticipate a positive remunerative stream from a successful innovation.

**Figure 4.**

SHARING REGIME THROUGH ASSET BUNDLING (FINANCIAL SERVICES, PRE-1998)[45]




Even if largely adopted for purposes of analytical expedience, the standard property/commons taxonomy obscures the rich complexity of actual innovation regimes, which encompass a variety of hybrid arrangements that offer a workable incentive structure for avoiding the standard underinnovation outcome without primary, or sometimes any, recourse to state-provided property rights. A sharing regime is a plausible, inherently attractive alternative to a property regime: if successful, it supports innovation incentives through remunerative streams partially shielded from third-party appropriation while sustaining a collective innovation pool that alleviates the transaction cost

45. Consistent with the previous Figures, increasing coloration indicates increasing strength of barriers to imitation. Note that "brand name" is given a darker coloration because it is protected by trademark, a legal entitlement.

expenditures that would otherwise inhibit subsequent innovation, which in turn substantially reduces the social price that must otherwise be paid to induce innovation investment. Based on repeated empirical surveys consistently showing that most industries place limited reliance on patent protection but substantial reliance on extralegal instruments to capture innovation returns[46] (and consistent with evidence described above indicating that innovators widely decline to maximally exploit available patent protections[47]), a sharing regime that mixes legal appropriation instruments, extralegal appropriation instruments, and open access zones represents by implication the *typically* adopted appropriation strategy in a large number of innovation markets. Multiple industries stand somewhere in between the commons/property alternatives at the ends of the propertization continuum: while some intellectual assets in the relevant market are securely protected by legal barriers, the substantial remainder are forfeited to an open-access innovation pool (or in milder variants to be discussed subsequently, limited-access innovation pools), while difficult-to-imitate or otherwise excludable collateral assets cover any resulting appropriability shortfall.

### *C. Propertization Theses (or Demsetz Meets Marx Meets Coase)*

If (i) we adopt the view that innovation regimes are largely a function of private expenditures on implementation actions; and (ii) we further adopt the view that innovation regimes are best situated along a graduated range of propertization outcomes, then we can complete our conceptual toolkit by identifying the selection mechanism that drives innovators' choice of implementation actions, which in turn substantially determines the propertization outcome. This line of inquiry necessarily takes as its point of departure the leading economic theory of property rights formation, as famously stated by Harold Demsetz. Namely, a society will expend additional resources to establish, administer, and secure property rights so long as (and

**46.** For the leading studies showing limited reliance on patent protection, see C.T. TAYLOR & Z.A. SILBERSTON, THE ECONOMIC IMPACT OF THE PATENT SYSTEM: A STUDY OF THE BRITISH EXPERIENCE (1973); Richard C. Levin et al., *Appropriating the Returns from Industrial Research and Development*, 1987 BROOKINGS PAPERS ON ECON. ACTIVITY 783; Edwin Mansfield, *Patents and Innovation: An Empirical Study*, 32 MGMT. SCI. 173 (1986); and Wesley M. Cohen, Richard R. Nelson & John P. Walsh, *Protecting Their Intellectual Assets: Appropriability Conditions and Why U.S. Manufacturing Firms Patent (or Not)* (Nat'l Bureau of Econ. Research, Working Paper No. 7552, 2000). For similar results in an earlier study, see FREDERIC M. SCHERER ET AL., PATENTS AND THE CORPORATION: A REPORT ON INDUSTRIAL TECHNOLOGY UNDER CHANGING PUBLIC POLICY (2d ed. 1959).

**47.** *See supra* Section I.A.

*only* so long as) asset values sufficiently increase relative to rights administration costs[48] (and/or, as Demsetz clearly implied and subsequent commentators clarified, rights administration costs sufficiently fall relative to asset values[49]). As further developed in the institutional economics literature, this thesis is usually formulated more generally as stating that any market dedicates resources to the promulgation and enforcement of property rights just up to the point where marginal internalization gains equal marginal internalization costs.[50] In applying this social cost-benefit calculus to the intellectual property context, it is important to observe (as stated at the outset) that innovation typically proceeds in a cumulative sequence consisting of an

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

**49.** *See* YORAM BARZEL, ECONOMIC ANALYSIS OF PROPERTY RIGHTS (1989); GARY D. LIBECAP, CONTRACTING FOR PROPERTY RIGHTS (1989); Terry L. Anderson & P.J. Hill, *The Evolution of Property Rights: A Study of the American West*, 18 J.L. & ECON. 163 (1975). As noted previously, this is not intended to be a complete statement of the welfare effects of increased levels of intellectual property coverage; there may be social costs in addition to transaction cost losses that must be offset against innovation gains. In particular, this standard omits the deadweight losses that are usually associated with increased levels of intellectual property protection as a result of output constraints imposed by intellectual property holders who rationally implement supracompetitive pricing, which in turn blocks efficient sales to some users willing at least to pay a price equal to marginal cost. Even from a consumer-welfare perspective, however, it is not clear that taking into account deadweight losses would make any difference "on net" so long as we also take into account the deadweight losses attributable to *reduced* levels of intellectual property protection. That too results in a decline in output, which in turn implies blocked efficient sales to users who would have been willing to pay the supracompetitive price that would have been demanded by the hypothetical intellectual property rights holder. Multiple antitrust commentators have expressed the view that the social costs to consumers from supracompetitive pricing are far outweighed by the social costs to consumers from technological delay as a result of reduced innovation. *See, e.g.*, Phillip Areeda, *Antitrust Law as Industrial Policy: Should Judges and Juries Make It?*, *in* ANTITRUST, INNOVATION, AND COMPETITIVENESS 29, 31 (Thomas M. Jorde & David J. Teece eds., 1992) (noting the widespread view among economists that "innovation has been thought to contribute far more to our well-being than keeping prices closer to costs through competition"); Frank H. Easterbrook, *Ignorance and Antitrust*, *in* ANTITRUST, INNOVATION, AND COMPETITIVENESS, *supra*, at 119, 122 ("An antitrust policy that reduced prices by 5 percent today at the expense of reducing by 1 percent the annual rate at which innovation lowers the costs of production would be a calamity."); Donald F. Turner, *Basic Principles in Formulating Antitrust and Misuse Constraints on the Exploitation of Intellectual Property Rights*, 53 ANTITRUST L.J. 485, 485 (1985) (noting that "in the long run, technological progress contributes far more to consumer welfare than does the elimination of allocative inefficiencies caused by noncompetitive pricing").

**50.** *See, e.g.*, PROPERTY RIGHTS: COOPERATION, CONFLICT, AND LAW 5 (Terry L. Anderson & Fred S. McChesney eds., 2003). For leading contributions in the literature, see BARZEL, *supra* note 49; LIBECAP, *supra* note 49; DOUGLASS C. NORTH, INSTITUTIONS, INSTITUTIONAL CHANGE AND ECONOMIC PERFORMANCE (1990); and ANDREW SCHOTTER, THE ECONOMIC THEORY OF SOCIAL INSTITUTIONS (1981).

initial innovation followed by a derivative flow of subsequent innovations, which means that allocating entitlements over upstream innovations can generate transaction costs that in turn impede downstream innovations.[51] This cumulative sequence requires adjusting the Demsetz thesis such that internalization gains from increased propertization are offset against internalization costs in the form of *both* (i) transaction costs (understood broadly to mean all costs relating to the administration, transfer, and enforcement of intellectual property)[52]; and (ii) subsequent innovation that would have taken place *but for* those transaction costs.[53] Note how transaction costs act as the critical brake on propertization levels: if transaction costs were set to zero, propertization could be confidently ratcheted up to cover all product attributes, thereby achieving complete internalization of all social gains (in the form of innovative output) at no offsetting social cost (in the form of transaction costs and associated innovation losses).[54]

Following this adapted formulation, any given propertization outcome generates a marginal net social gain only to the extent that, relative to some weaker propertization outcome, it yields a *cumulative stream* of marginal innovation gains (that is, initial *plus* subsequent innovation gains) in excess of marginal transaction costs. Where this is *not* the case, the propertization outcome is socially excessive: that is, it has depleted, rather than enlarged, the

51. On the sequential nature of most innovation processes, see WILLIAM J. BAUMOL, ENTREPRENEURSHIP, MANAGEMENT, AND THE STRUCTURE OF PAYOFFS 181-84 (1993). For the leading economic analysis of sequential innovation, see Suzanne Scotchmer, *Standing on the Shoulders of Giants: Cumulative Research and the Patent Law*, 5 J. ECON. PERSP. 29 (1991).

52. This broad definition is standard usage in the property rights literature. Note, however, that I *exclude*: (i) costs related to appropriating the value of *un*protected intellectual assets, which would be *reduced* by intellectual property protections; or (ii) amounts paid to access *protected* intellectual assets, which are transfer payments without any implications from a social efficiency perspective.

53. A clarification and a caveat. First, note that subsequent innovation losses must be restricted to subsequent innovation that still would have been generated under some weaker level of propertization (either due to the assumption of intrinsic motivations or access to equivalent technological inputs in the public domain). This is sometimes overlooked. Second, to reiterate earlier disclaimers, *see supra* notes 7 and 49, the tradeoff stated above does not completely describe the bundle of social costs and benefits generated by greater or lesser levels of propertization.

54. In a zero transaction costs world, the holder of any intellectual property entitlement would rationally bargain to mutually efficient transactions with any derivative follow-on inventors. I note that more complex economic analysis of the first-mover/second-mover scenario stipulates additional conditions for this efficiency result to hold with certainty, although these too can be at least partially satisfied by assuming prior agreements between first-mover and second-mover innovators (which would by definition take place in a zero transaction costs world). *See* Scotchmer, *supra* note 51.

total social product relative to some weaker propertization outcome. The Demsetz efficiency thesis (or what I will call the "Never Too Much Property" (NTMP) thesis) implies by definition that this adverse outcome will *never* be realized: that is, any observed increase in property rights coverage over any given pool of innovation assets necessarily results in a net social gain by generating marginal innovation gains in excess of marginal transaction costs (otherwise it would never have taken place!). If "what is, is optimal," then the expansionary trend in intellectual property coverage need not raise any alarm: it simply constitutes a socially cost-justified adjustment of property rights in response to an upward shift in relevant asset values (and/or a downward shift in rights-administration costs). This does not seem wholly implausible: historically, extensions of formal intellectual property coverage often appear to correlate roughly with apparent increases in the economic value of the relevant innovation market. Thus, software received increasingly stronger property rights protection (from copyright to unclear patent to clear patent protection[55]) roughly coincident with the rise of the personal computer and corresponding growth in demand for software applications; and the biotechnology industry received increasingly stronger property rights protection for some of its products as technological advances in the life sciences started yielding valuable research and therapeutic tools;[56] and so on.

As is widely observed, however, this "happy" approach to property rights formation suffers from a crucial shortcoming: namely, it fails to operationalize the transition from commons to property and, consequently, fails to address the obvious possibility that, given the inherent divergence between the public

55. The leading decision is *Diamond v. Diehr*, 450 U.S. 175 (1981), which recognized the eligibility of software for patent protection so long as the software is implemented by a process or apparatus that itself would be eligible for patent protection. This decision was expanded subsequently to progressively remove the "process or apparatus" limitation. *See* AT&T v. Excel Commc'ns, 172 F.3d 1352, 1356-60 (Fed. Cir. 1999) (following the decision in *State Street Bank & Trust Co. v. Signature Financial Group, Inc.*, 149 F.3d 1368 (Fed. Cir. 1998), which rejected the claim that patentable software must have physical structure associated with it, so long as it otherwise produces a "useful, concrete and tangible result"); *In re* Alappat, 33 F.3d 1526, 1540-45 (Fed. Cir. 1994) (en banc) (holding that the "statutory process or apparatus" test is satisfied so long as the relevant claim is drafted to include a general purpose computer or standard hardware or memory element necessary for useful application of the relevant algorithm).

56. For the leading judicial decisions and agency actions, see Diamond v. Chakrabarty, 447 U.S. 303 (1980), which upheld a patent on genetically engineering microorganisms; 1118 O.G. 19 (1987), which stated that PTO "now considers non-naturally occurring non-human multicellular living organisms, including animals, to be patentable subject matter"; and Amgen, Inc. v. Chugai Pharmaceutical Co., 927 F.2d 1200 (Fed. Cir. 1991), which upheld a patent on purified and isolated DNA sequences encoding a red blood cell-stimulating protein.

interest and the private interests of market participants, the state's introduction of property entitlements may not always (or some would say, may only infrequently and accidentally[57]) result in a net social gain.[58] Following this distributive approach (which I will call the "Always Too Much Property" (ATMP) thesis), excessive propertization outcomes are endemic, either actually or at least potentially, given the disproportionate rent-seeking incentives and capacities of large existing holders who seek to secure unequal resource distributions, even if this yields a net social loss. Put differently: private parties that exert determinative influence over state action have rational interests that inherently diverge from the public interest, and hence, there can be no confidence that rent-seeking investments will yield socially desirable propertization outcomes. Applied strictly to the contemporary intellectual property context, the ATMP thesis would necessarily imply that, despite vigorous innovation in recently and substantially propertized markets such as biotechnology, semiconductors, and software, these markets would have generated an even higher net social product (equivalent to cumulative innovation gains less transaction costs) under some weaker level of propertization.

Translated into the more casual terms of popular and some scholarly commentary on intellectual property, the rent-seeking critique corresponds approximately to the oft-stated view that "Big Media," "Big Pharma," or "Big Tech" consistently seeks to strengthen intellectual property rights to the maximum extent possible as political conditions and resource constraints allow, irrespective of whether doing so imposes (or precisely in order to impose) high input costs on small innovators, thereby constraining entry, and high retail prices on individual end users, thereby maximizing profits.[59] In its

57. *See* DOUGLASS C. NORTH, INSTITUTIONS, INSTITUTIONAL CHANGE AND ECONOMIC PERFORMANCE 73, 110 (1990). Given this deficiency, the Demsetz thesis has been called a "naïve" theory of property rights formation. *See* THRAINN EGGERTSSON, ECONOMIC BEHAVIOR AND INSTITUTIONS 250, 272-73 (1990).

58. *See* Stuart Banner, *Transitions Between Property Regimes,* 31 J. LEGAL STUD. S359 (2002); Saul Levmore, *Property's Uneasy Path and Expanding Future,* 70 U. CHI. L. REV. 181 (2003); Saul Levmore, *Two Stories About the Evolution of Property Rights,* 31 J. LEGAL STUD. S421 (2002). In the economics and political science literature, there exist several dedicated critiques of the Demsetzian and related efficiency driven theories of institutional formation from a distributive and/or strategic bargaining perspective. *See, e.g.*, DANIEL W. BROMLEY, ECONOMIC INTERESTS AND INSTITUTIONS: THE CONCEPTUAL FOUNDATIONS OF PUBLIC POLICY (1989); JACK KNIGHT, INSTITUTIONS AND SOCIAL CONFLICT (1992); ITAI SENED, THE POLITICAL INSTITUTION OF PRIVATE PROPERTY (1997).

59. For examples along these lines, see LAWRENCE LESSIG, FREE CULTURE: HOW BIG MEDIA USES TECHNOLOGY AND THE LAW TO LOCK DOWN CULTURE AND CONTROL CREATIVITY (2004); LAWRENCE LESSIG, THE FUTURE OF IDEAS: THE FATE OF THE COMMONS IN A

more sophisticated and nuanced forms, the ATMP thesis tracks the widely expressed view that innovation markets suffer from an intellectual property thicket (or "anticommons") where a misguided proliferation of property rights stifles innovative output beneath access restrictions, dispute-resolution actions, and other administrative burdens.[60] At its core, the ATMP thesis certainly has substantial merit—indeed, it is fully compatible with this Article's functionalist view of propertization outcomes as largely the product of self-interested rent-seeking expenditures. However, it has a crucial blind spot: at least in its less nuanced formulations, the ATMP thesis almost certainly must be overstated as a complete account of *ultimate* rights allocation outcomes since it necessarily assumes that adversely affected populations *never* have sufficient incentives and/or capacities to make adjustments that yield at least a socially preferable propertization outcome.[61] Not just *almost certainly* but *actually*: as we shall see

CONNECTED WORLD (2001); and James Boyle, *The Second Enclosure Movement and the Construction of the Public Domain*, LAW & CONTEMP. PROBS., Winter/Spring 2003, at 33. This is in an indicative, not complete, list of references. For reviews of this literature, see, for example, R. Polk Wagner, *Information Wants To Be Free: Intellectual Property and the Mythologies of Control*, 103 COLUM. L. REV. 995 (2003).

60. Other scholars have made similar observations. *See, e.g.*, David E. Adelman & Kathryn L. DeAngelis, *Patent Metrics: The Mismeasure of Innovation in the Biotech Patent Debate*, 85 TEX. L. REV. 1677, 1679 (2007) (noting but also challenging "the widely held belief that the rapid growth in biotechnology patenting over the last decade is impeding innovation"); F. Scott Kieff & Troy A. Paredes, *Engineering a Deal: Toward a Private Ordering Solution to the Anticommons Problem*, 48 B.C. L. REV. 111, 112 (2007) (noting the recent "explosion" in the intellectual property literature on the anticommons problem, which asserts that the proliferation of patent rights can retard innovation). For the leading expression of the anticommons thesis, see Michael A. Heller, *The Tragedy of the Anticommons: Property in the Transition from Marx to Markets*, 111 HARV. L. REV. 621 (1998), which states that excessively fragmented property rights can generate net social losses by impeding, rather than facilitating, innovation (or, in a broader real property context, other) investments; and Michael A. Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 SCIENCE 698 (1998), which advances the same thesis with respect to gene patents. For some of the most sophisticated arguments and empirical evidence advanced in favor of various forms of the patent thicket thesis, see JAMES BESSEN & MICHAEL J. MEURER, PATENT FAILURE: HOW JUDGES, BUREAUCRATS, AND LAWYERS PUT INNOVATORS AT RISK (2008); ADAM B. JAFFE & JOSH LERNER, INNOVATION AND ITS DISCONTENTS: HOW OUR BROKEN PATENT SYSTEM IS ENDANGERING INNOVATION AND PROGRESS, AND WHAT TO DO ABOUT IT 4 (2004); and Carl Shapiro, *Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard Setting*, *in* 1 INNOVATION POLICY AND THE ECONOMY 119 (Adam B. Jaffe, Josh Lerner & Scott Stern eds., 2000). This is a highly selective list of references; a much larger legal literature has applied the thicket and anticommons concepts in a variety of contexts.

61. For related views, see Robert P. Merges, *Contracting into Liability Rules: Intellectual Property Rights and Collective Rights Organizations*, 84 CAL. L. REV. 1293, 1320-21 (1996), which argues that the conventional approach falsely imagines that private parties can do little about

subsequently, the extreme pessimism that characterizes the strongest versions of the ATMP thesis is falsified by multiple instances where innovator populations—and in particular, concentrated and well-endowed innovator populations—that are adversely affected by increased propertization have undertaken corrective actions to alleviate the attendant transaction cost burdens on innovation activity, up to and including outright forfeitures of valuable pools of knowledge assets.

To understand why this pessimistic prognosis is almost certainly false merely as a blanket theoretical proposition, let us briefly revisit Demsetz through the lens of Ronald Coase, who is the source of the most influential theory of what might be called the private adjustment of state allocated entitlements. Assuming zero transaction costs (and setting aside distributive considerations), Coase shows that the initial allocation of any legal entitlement is a matter of indifference from a social point of view because affected parties will rationally bargain to the efficient reallocation.[62] While this is obviously an idealized state of affairs that will rarely be realized as a practical matter, it yields the valuable implication that, where transaction cost obstacles are *not* exorbitant, private parties will have rational incentives and at least *some* capacity to adjust socially undesirable allocations of legal entitlements. This well-known insight can in turn be applied to generate a working hypothesis concerning an innovation market's potential ability to correct any excessive allocation of intellectual property rights. Assuming that the Coasean condition of minimal coordination costs is at least substantially satisfied, there is reasonable confidence that the socially preferred outcome envisioned (but not operationalized) by the Demsetz thesis (and entirely excluded by the rent-seeking critique except as a matter of chance) *will* be substantially realized over some reasonable period of time. This possibility will be realized so long as we do not exclude an important (and entirely reasonable) contingency (which *must* be the case for the too much property thesis to hold in any single instance): namely, as the level of propertization increases, marginal transaction costs accelerate, with resulting losses in the form of depressed subsequent innovation, such that the diminishing stream of marginal innovation gains cannot make up the difference. Where this is the case, further movement down

property entitlements incorrectly issued by the state and advances instead an approach that focuses on parties' ability to modify legal entitlements through social norms and cooperative institutions. For a similar statement in the property rights school more generally, see CARL J. DAHLMAN, THE OPEN FIELD SYSTEM AND BEYOND: A PROPERTY RIGHTS ANALYSIS OF AN ECONOMIC INSTITUTION 220 (1980), which states that the property rights approach recognizes that even the "losers in institutional change" can use bargaining power and/or form voluntary associations to adjust the effective property rights allocation.

**62.** *See* R.H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1 (1960).

the regime path toward complete propertization will fail to yield a net social gain, in which case a less protected point on the regime path will be socially (and, at least for some innovators, privately) preferred to any more protected point.[63] Given this contingency, even (and, as I shall argue shortly below, *especially*) large entitlement holders—the presumptive culprits following the ATMP thesis—may therefore have individually rational incentives to scale back overextended intellectual property rights, thereby alleviating transaction costs and enhancing the cumulative stream of innovative output in at least partial consistency with the social interest.

In place of the ATMP thesis and the NTMP thesis, I pursue an intermediate position, which I call the "Sometimes Too Much Property" (STMP) thesis. The market will tend to adjust excessive allocations of intellectual property entitlements in order to maximize the cumulative stream of innovation gains net of transaction costs, assuming two conditions are satisfied: (i) adversely affected innovators tend to be neither substantially net users nor substantially net producers of the relevant pool of innovation assets, which implies that innovators have a close-to-neutral bias relative to the socially interested level of property rights coverage; and (ii) adversely affected innovators tend to be few in number (or collectively organized) and occupy a dominant market position, which implies strong individual incentives to undertake costly efforts to promote, and low coordination cost obstacles to reach collectively beneficial propertization outcomes. Substantial satisfaction of these predicate conditions yields an approximate alignment over time between private and social interests in selecting among the possible range of propertization outcomes. First, resource holders that tend to be both producers and users of intellectual assets—that is, they make substantial use of outside

**63.** This point recalls two important propositions found in the transaction costs literature on property rights. First, Demsetz observed in another publication that complete markets may sometimes be less preferred relative to incomplete markets to the extent that fully pricing all externalities in a complete market is an activity that diverts resources to policing market exchanges without necessarily generating commensurate social benefits in the form of allocative efficiencies. *See* Harold Demsetz, *The Exchange and Enforcement of Property Rights*, 7 J.L. & ECON. 11 (1964). Second, other commentators have shown that an increase in asset values may not always precipitate further expenditures on rights enforcement since an increase in asset values can attract greater third party investments in thievery, thereby increasing policing costs that may swap any gains from increased propertization. *See* Douglas W. Allen, *The Rhino's Horn: Incomplete Property Rights and the Optimal Value of an Asset*, 31 J. LEGAL STUD. S339 (2002); Barry C. Field, *The Evolution of Property Rights*, 42 KYKLOS 319, 328 (1989). In more general forms of the latter point, other commentators have observed that property rights over any given item may not be fully defined to the extent that doing so generates transaction costs without commensurate efficiency gains. *See* BARZEL, *supra* note 49, at 64-67.

sources to access required innovation inputs—wish to accrue *both* internalization gains, which requires more "property" (consistent with the ATMP thesis), *and* to minimize at least some internalization costs, which requires less "property" (consistent with the NTMP thesis).[64] Second, if group size is small (or large but collectively organized) and occupies a dominant portion of the relevant market, then the dilution of cooperation gains is inherently limited, in which case adversely affected innovators may rationally expect to accrue individual gains commensurate with individual expenditures required to implement collectively beneficial adjustments to overpropertization outcomes.[65] While the NTMP thesis assumes that the market always gets it right by tending toward socially optimal propertization and the ATMP thesis assumes that the market always gets it wrong (subject to getting it right occasionally by chance) by tending toward socially excessive propertization, the STMP thesis assumes that, taking into account some reasonable lag time required to implement adjustments by adversely affected and economically dominant interests, the market tends to get it at least *substantially* right over time, in general moving between propertization outcomes situated in the intermediate region between the exact perfection anticipated by the NTMP thesis and the gross imperfection anticipated by the ATMP thesis.

## II. ERRORS AND CORRECTIONS ON THE REGIME PATH

If the market always perfectly implemented the social cost-benefit principle as it selected points on the graduated regime path (following the NTMP thesis), then an erroneous propertization outcome would be an impossibility (and the ATMP thesis would be a complete falsehood), since innovators would rationally decline to use any extension of intellectual property coverage that is not socially cost-justified relative to the existing set of legal and/or extralegal appropriation mechanisms.[66] But this undiluted confidence in the regime selection process would necessarily assume that collective rationality will always coincide with individual rationality among innovator populations. To examine the extent to which individually rational consumption of intellectual property *sometimes* (but not chronically and irremediably, as the ATMP thesis would imply) diverges from socially interested levels, below I explore stylized

64. For further discussion, see *infra* note 112 and accompanying text.

65. For further discussion, see *infra* notes 86-87 and accompanying text.

66. For the only dedicated statement of this view (to my knowledge), see Easterbrook, *supra* note 2, at 412.

movements between a property regime and a sharing regime[67] for the purpose of identifying circumstances where innovation markets are likely to select and/or fail to correct socially excessive propertization outcomes within some reasonable time frame. Whether or not the market fails or succeeds in this endeavor is not a matter of chance. Consistent with the nuanced approach of the STMP thesis (and contrary to both the pessimism of the ATMP thesis and the optimism of the NTMP thesis), I advance the following hypothesis: (i) where coordination costs are high, innovation markets are likely to fall into a property trap that settles upon and cannot easily adjust socially excessive propertization outcomes; but (ii) where coordination costs are low (*and* adversely affected innovators have a close-to-neutral propertization bias), innovation markets are likely to escape from the property trap by undertaking collectively beneficial actions that directly or, perhaps of greatest practical interest, indirectly correct socially excessive propertization outcomes. While the property trap outcome is an inherent danger (so long as we assume conditions that give rise to positive coordination costs), it may sometimes be a self-correcting malady: even without state intervention, concentrated or well organized innovator populations that tend to stand on both sides of intellectual property transactions have rational incentives and inherent capacities to overcome coordination cost obstacles in order to accrue joint gains from recalibrating overextended levels of property rights coverage.

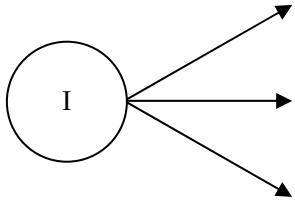
### *A. Falling into the Property Trap*

Let us return to the financial services market prior to 1998. As described earlier, this constituted a sharing regime that sustained innovative output without intellectual property protections (other than trademark), thereby sparing industry participants the transaction cost losses attendant to a formal property regime. But not all is well in paradise. This cooperative idyll—which arguably operated to the collective benefit of most firm participants—was inherently unstable so long as any firm could, at some reasonable cost and at some reasonable likelihood of success, "defect" by seeking, or more aggressively enforcing, formal property rights protections made available by

**67.** Generally, I do *not* focus on market movements between a commons and a property regime, which is the more typical focus in the economic and legal literature on the evolution of property rights, both in the real-property and intellectual property contexts. This is both for reasons of brevity and because I am of the view that the commons is not especially relevant, for the simple reason that zero propertization usually does not offer a sustainable environment for innovation investment. I address this point in greater detail in a companion piece. *See* Barnett, *supra* note 38.

the state. The Figure below depicts three possible defection actions (where "I" denotes innovator) that can undermine a sharing regime, as follows:

**Figure 5.**
DEFECTION ACTIONS




***Defect(petition)*** = Petition the legislature or agency for extensions to existing intellectual property coverage

***Defect(adopt)*** = File an application with the relevant agency to issue an intellectual property entitlement over novel subject matter

***Defect(enforce)*** = Adopt and enforce available but "dormant" intellectual property protections

*Defect(adopt)* and *defect(enforce)* are the least costly forms of any unilateral activation of formal property rights, corresponding approximately to "crazy" patents issued by the PTO or "surprising" court decisions upholding novel patent or copyright claims brought by "aggressive" entitlement holders, which together drive the incremental process by which doctrinal limitations on patentable or copyrightable subject matter are progressively dismantled. Over the course of almost two decades, the financial services market underwent incremental propertization as a result of defecting innovators that successfully elicited agency or court action to expand available intellectual property coverage. Starting in the 1970s, the PTO began to issue patents for nontechnical business methods (equivalent to *defect(adopt)*), which had been widely understood to be unpatentable,[68] and which led to a handful of litigations (concluding in settlement).[69] Doubts arising from doctrinal obstacles to legal enforceability—most notably, the historical bar on patenting abstract ideas in general and mathematical algorithms in particular—were

68. For the decision establishing the business methods limitation (that is, the ineligibility of non-technical methods of doing business for patent protection), see *Hotel Security Checking Co. v. Lorraine Co.*, 160 F. 467 (2d Cir. 1908).

69. *See* Josh Lerner, *Where Does* State Street *Lead? A First Look at Finance Patents, 1971-2000* (Nat'l Bureau of Econ. Research, Working Paper No. 7918, 2000), at 8. For one such litigation, see *Paine, Webber, Jackson & Curtis, Inc. v. Merrill Lynch, Pierce, Fenner & Smith, Inc.*, 564 F. Supp. 1358, 1368 (D. Del. 1983), which rejects a challenge to the validity of a patent held by Merrill Lynch claiming a Securities Brokerage-Cash Management System.

eroded by Federal Circuit decisions issued during the 1980s and 1990s and a change in 1996 to PTO examination guidelines, which instructed examiners that claims could not be rejected solely because they covered methods of doing business.[70] These doubts were ultimately cast aside by the Federal Circuit's 1998 decision, *State Street Bank & Trust Co. v. Signature Financial Group, Inc.*, which explicitly rejected the historical exclusion of business method patents.[71] In that litigation, brought by a small financial services firm against a long-established market leader in custodial services for the financial services industry, the court rejected subject matter objections to a patent for a computer implemented data processing system that facilitates the financial administration of multiple mutual funds through a common investment portfolio.[72] This progressive change in propertization outcomes, cultimating in the *State Street* decision, led to a sharp rise in business method patent applications, which, subject to periodic fluctuations, has continued through the present day.[73]

But patenting volume alone is not sufficient to imply that complete or even substantial propertization of the financial services sector was and is an inevitable outcome of the 1998 decision and the extended sequence of defection actions that precipitated it. Any successful defection action by a single innovator *formally* promulgates a novel property regime, which in turn displaces the existing sharing regime *only* to the extent that a substantial

70. The erosion of the business methods limitation is largely a function of the expansion of protection for software applications. For the leading decisions that anticipated *State Street*, see *Diamond v. Diehr*, 450 U.S. 175, 187-88 (1981), which upheld a patent claim about a process for curing rubber even though it "employs a well-known mathematical equation" and stating generally that a claim directed to subject matter that is otherwise patentable does not become unpatentable "simply because it uses a mathematical formula, computer program, or digital computer"; and *In re Alappat,* 33 F.3d 1526, 1542-44 (Fed. Cir. 1994) (en banc), which, following *Diehr,* held that the statutory "process" or "machine" test for patentable subject matter is satisfied so long as the patent claim "*as a whole*" is directed to an apparatus to produce a "useful, concrete, and tangible result," even if the claimed machine accomplishes that result through a mathematical formula that would not be patentable subject matter by itself. In turn, these decisions were grounded in the Court's earlier decision, *Diamond v. Charkrabarty*, 447 U.S. 303 (1980), which generally counseled a broad interpretation of patentable subject matter under 35 U.S.C. § 101.

71. 149 F.3d 1368 (Fed. Cir. 1998).

72. Data Processing Sys. for Hub & Spoke Fin. Servs. Configuration, U.S. Patent No. 5,193,056 (filed Mar. 11, 1991) (issued Mar. 9, 1993).

73. Robert M. Hunt, *Business Method Patents and U.S. Financial Services* 3-4 (Fed. Res. Bank of Phila., Working Paper No. 08-10/R, 2009), *available at* http://www.philadelphiafed.org/research-and-data/publications/working-papers/2008/wp8-10.pdf (last visited Oct. 14, 2009).

portion of the general innovator population then similarly defects by allocating resources to adopting the novel entitlement and enforcing it (equivalent to *defect(enforce)*). If a formal intellectual property entitlement is unilaterally introduced but then neither adopted nor enforced by most eligible holders, then it can safely be concluded that the innovator population has rationally declined to incur the expenditures necessary to implement it, thereby perpetuating a sharing regime that persists in the shadow of a largely inactive property regime. In electing whether to incur these implementation costs, any repeat-player innovator must weigh the expected net payoff streams available from two alternative actions: (i) the "sharing payoff" available by electing to continue to cooperate with the existing sharing regime (practically equivalent to declining to petition, adopt, or enforce property rights protections); and (ii) the "property payoff" available by electing to defect into the property regime following any of the defection actions indicated above. Any payoff amount is constituted by the discounted present value of the cumulative stream of innovation gains (that is, initial plus subsequent innovation gains) less transaction costs and input costs. Whereas a property regime offers increased innovation gains at the price of increased transaction costs and input costs, a sharing regime offers reduced input costs and transaction costs at the price of reduced innovation gains. If there already exist other mechanisms by which innovators can capture innovation returns (a typical case),[74] then the marginal gain in innovation returns under a property regime may be insubstantial and fail to exceed the marginal losses attributable to the associated cost burden, in which case innovators will rationally decline to adopt and/or enforce a novel property right made available by the state.

Now suppose that most firms in the financial services industry conclude that the sharing payoff exceeds the property payoff, in which case these firms should rationally decline to exploit the newly available patent right, which should in turn lapse into a practical nullity. But not all innovators will necessarily reach this conclusion; in particular, a one-shot player who seeks to maximize short-term payoffs (equivalent practically to the much maligned "patent troll"[75]) will *never* reach this conclusion and, assuming reasonable defection costs, will therefore vigorously pursue available legal protections. Given that initial innovation gains accrue immediately while the losses from

74. For extensive discussion of these alternative instruments, see Barnett, *supra* note 44, at 1257-69.

75. This is the widely used pejorative term for holding companies that acquire patents solely for purposes of licensing the patent to operating companies in the relevant field or, failing an agreement to license, litigating the patent to extract a settlement or infringement damages. For further discussion, see *infra* notes 138-143 and accompanying text.

transaction costs, input costs, and impeded subsequent innovation are mostly incurred sometime in the future, the one-shot innovator rationally ignores offsetting losses (other than immediate lobbying and/or litigation costs) and seeks to accrue the marginal innovation gains immediately available under a property regime. This observation reveals a crucial vulnerability of any sharing regime: it is exposed to unraveling by the one-shot player who anticipates, or any other "idiosyncratic" player who has *some* reason rationally to anticipate, a higher net payoff stream under a property regime for the duration of its anticipated participation in the market.[76] To see why, suppose that an idiosyncratic innovator (for example, the small financial services company that initiated the *State Street* litigation) makes an unconventional patent application that is surprisingly accepted by the PTO and then surprisingly upheld by a court when its validity is contested by an alleged "nonidiosyncratic" infringer (for example, the large financial services incumbent targeted in the *State Street* litigation). This unilateral activation of formal property rights by even a single firm may then sufficiently reduce the expected payoff available under the existing sharing regime such that the general population of nonidiosyncratic innovators rationally elects to defect into the novel property regime. This outcome will result so long as any nondefecting innovator anticipates that, as the number of defecting innovators increases, transaction costs and input costs will rise sufficiently due to contraction of the common innovation pool and expansion in the infringement claims pursued by defecting firms, such that a sharing regime loses its relative cost advantage over a property regime. Absent the ability to coordinate future migration, fears of an impending "patent flood" become a self-fulfilling prophecy: individual rational actions to protect against anticipated infringement claims and anticipated barriers to innovation inputs drive full-scale deployment of a property regime even if joint payoffs would be maximized under the existing sharing regime.

Figure 6 *potentially* illustrates this effect: an initial activation of property rights by a single plaintiff in the *State Street* litigation has resulted in the subsequent and rapid issuance of thousands of business methods patents in a market that had previously supported robust innovation rates without formal propertization and apparently had never previously lobbied for such rights.[77]

**76.** In a companion publication, I provide greater content to idiosyncratic preferences for defecting from a sharing regime, arguing that poorly endowed and richly endowed innovators (who, respectively, are rationally excluded from or rationally decline to participate in the collective innovation pool that sustains a sharing regime) are most likely to abandon an existing sharing regime. *See* Barnett, *supra* note 38.

**77.** The Figure shows the number of patents classified (either on an "original" or "cross-reference basis") under Class 705 of the U.S. Patent Classification system, which is

Taking into account natural lags in the patent application process (on average as of 2007, almost thirty-two months from application date to issue date[78]), we can roughly observe that, following initial erosion of the business methods limitation in 1994, patenting rates began to climb moderately and then climbed sharply following the July 1998 decision that expressly lifted the business methods limitation and continued in the same direction following a 1999 Federal Circuit decision that reaffirmed *State Street*[79] and a 1999 district court ruling that issued a preliminary injunction in support of the notorious Amazon "one-click" business method patent.[80] Patenting rates then spiked upward again following settlements of approximately $50 million in August 2002 and December 2003 by multiple financial exchanges with eSpeed, an aggressive litigant of financial method patents,[81] and, since 2002, litigation by the "Data Treasury" firm, which has brought suit against over fifty financial services

commonly associated with business method patents (and therefore includes, but is not restricted to, financial method patents) and is called "Data Processing: Financial, Business Practice, Management, or Cost/Price Determination." Sources for the data shown are from Part A1, Table A1-2 of U.S. PATENT & TRADEMARK OFFICE, PATENT COUNTS BY CLASS BY YEAR (2008), http://www.uspto.gov/go/taf/cbcby.htm. Note that Class 705 is both underinclusive and overinclusive with respect to finance-related patents: (i) underinclusive since some financial method patents may be classified under other categories and, of greater relevance; (ii) overinclusive since some Class 705 patents may be business method patents but not financial method patents. Nonetheless, Class 705 is a useful proxy for showing general trends. For a similar approach, see Merges, *supra* note 12, at 4 tbl. For an approach that creates a financial method patent data set by inclusion of limited subclasses, see Lerner, *supra* note 69, at 904-05. For an introduction to the PTO classification system, see U.S. Patent & Trademark Office, Overview of the U.S. Patent Classification System (USPC), http://www.uspto.gov/web/offices/opc/documents/overview.pdf.

78. U.S. PATENT & TRADEMARK OFFICE, PERFORMANCE AND ACCOUNTABILITY REPORT: FISCAL YEAR 2007, at 16 (2007), http://www.uspto.gov/web/offices/com/annual/2007/2007annualreport.pdf. Corresponding values for 2004, 2005, and 2006 are, respectively, approximately twenty-eight months, twenty-nine months, and thirty-one months. *Id.*

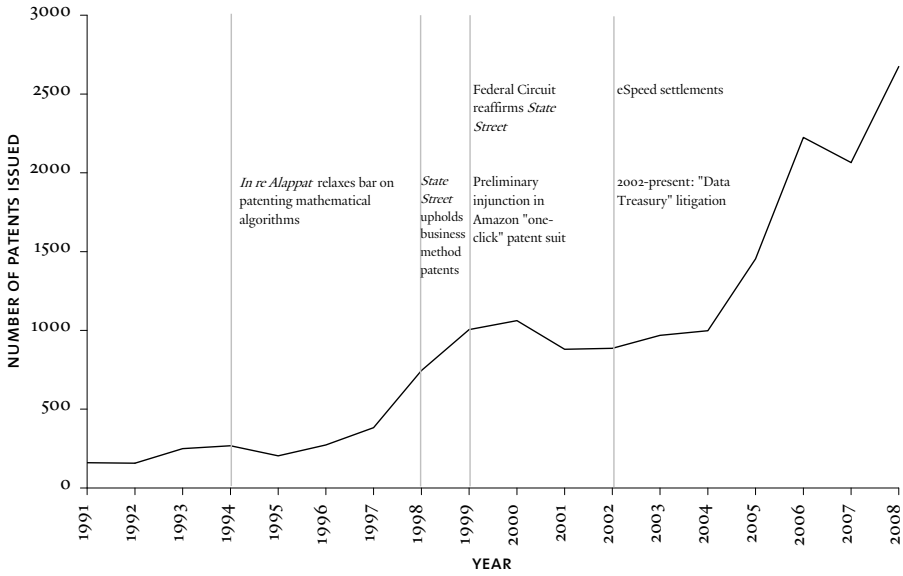
79. AT&T Corp. v. Excel Commc'ns, Inc., 172 F.3d 1352 (Fed. Cir. 1999).

80. Amazon.com, Inc. v. Barnesandnoble.com, Inc., 73 F. Supp. 2d 1228 (W.D. Wash. 1999). The patent at issue is Method and System for Placing a Purchase Order Via a Communications Network, U.S. Patent No. 5,960,411 (filed Sept. 12, 1997) (issued Sept. 28, 1999), which covers the technique of enabling consumers to make online purchases with a single click, using payment information entered previously by the user.

81. For information on patent application and award rates through 2000, see Lerner, *supra* note 69, at 907 fig.1. For information on litigation relating to finance patents issued through 2003, see Josh Lerner, *The Litigation of Financial Innovations* (Harvard Bus. Sch. Working Paper 09-027, 2008). For an example of a widely noted settlement, see Press Release, eSpeed and New York Mercantile Exchange Reach Settlement Agreement on Wagner Patent (Dec. 22, 2003), *available at* http://www.espeed.com/articles/article20031222.htm, which reported that eSpeed had settled a business method patent suit against New York Mercantile Exchange for $8 million.

firms with claims of over $1 billion in damages concerning a widely used check-processing and transmission technology.[82]

**Figure 6.**
PROPERTY UNLEASHED (CLASS 705 PATENTS)




Whether or not nonidiosyncratic innovators defect into a property regime largely turns on the litigation risk imposed by the activated set of property entitlements. Litigation risk is understood broadly to encompass both (i) input costs in the form of anticipated settlement payouts to claimants; and (ii) transaction costs in the form of legal fees, monitoring and reporting procedures, or other costly precautions. A nondefecting innovator that elects to cooperate with the existing sharing regime is an exposed litigation target to the extent that either (i) it does not have its own portfolio of property rights with

**82.** The projected damages figure is based on a report issued by the Congressional Budget Office, which calculated the amounts that could be demanded in a takings action against the federal government by the "Data Treasury" patent holders in the event immunity were granted to the alleged infringers. *See* CONGRESSIONAL BUDGET OFFICE, COST ESTIMATE, S. 1145, PATENT REFORM ACT OF 2007, at 2-3, 5-6, 11 (2008), http://www.cbo.gov/ftpdocs/89xx/doc8981/s1145.pdf. Note that some defendants have already settled. *See Latest Data Treasury Settlements Add to Pressure on Defendants*, Digital Transactions, Sept. 9, 2008, http://www.digitaltransactions.net/newsstory.cfm?newsid=1910 (noting settlements with Bank of New York and others, leaving forty-seven remaining defendants, including Bank of America and Citigroup).

which to threaten, deter, or settle opportunistic litigation (or at least lower the cost of settlement); or (ii) its privately practiced (but not publicly disclosed) innovations may be claimed by a third party under the property regime (as can be the case under the U.S. patent system, which usually does not recognize any prior user defense[83]). In the patent context, litigation risk is further aggravated by two additional factors. First, when patent protection is initially extended to a new field of activity, inexperience on the part of the PTO, together with a limited prior art database, may make it easier for "low quality" and/or unjustifiably broad patents to be granted, thereby distorting upwards the scope and number of patents in the relevant market, which in turn enhances perceived litigation risk, and enhances incentives to migrate to the property regime. Second, the U.S. patent system does not require disclosure of patent applications until eighteen months following the initial filing (and no disclosure until issuance in the absence of a foreign patent application),[84] which can lead to overestimates of the perceived migration rate that in turn give firms incentives to seek patent protection in the absence of any credible commitment from other industry players that they will not do so (or have not already done so). Innovators' perceptions of litigation risk may be further exacerbated by the intermediary populations that derive income from the adoption and enforcement of formal intellectual property rights (mostly lawyers), who may have incentives to promote adoption of the property regime among existing innovators by increasing the *perceived* defection rate, thereby further depressing expected payoffs under the sharing regime and further accelerating the *actual* defection rate.

### *B. Escaping the Property Trap*

The property trap scenario approximately tracks the pessimism of the ATMP thesis, which envisions that the state imposes property rights protections even in markets that can sustain vigorous innovation without them, which must then suffer the effects of constrained research and

**83.** Not coincidentally, the only exception to this statement is the business methods class of patents, which *is* subject to a prior user defense, under legislation enacted in 1999 as a result of financial industry pressure. For further discussion, see *infra* note 88 and accompanying text.

**84.** All patent applications filed on or after November 29, 2000 must be published within eighteen months of the date of filing, unless (i) the applicant requests that the PTO not publish the application and (ii) the applicant has not filed an application for the same invention in a foreign jurisdiction that also requires publication. *See* 35 U.S.C. § 122(b)(1)(A)-(B) (2000); American Inventors Protection Act of 1999, Pub. L. No. 106-113, § 4508, 113 Stat. 1501 (giving effective date).

development. But there is a crucial qualification that fundamentally diverges from the ATMP thesis: namely, the property trap is strictly dependent upon the inability of adversely affected innovator populations to sufficiently overcome coordination costs so as to undertake collectively beneficial actions that would break the trap. Where this empirical fact does not hold (meaning, coordination cost obstacles *are* overcome) *and* the innovator populations are neither clearly net users nor net producers of the relevant pool of intellectual assets, then there is substantially greater confidence that the market is likely to move to a socially preferred point on the regime path that generates marginal innovation gains in excess of marginal transaction costs.[85] Adversely affected innovators can sometimes stop the slide into the property trap or, if not, climb their way out, by taking two actions that limit the practical scope of intellectual property coverage: (i) *direct truncation*, in the form of lobbying actions that, if successful, result in formal modifications that weaken the relevant legal entitlement; and (ii) *indirect truncation*, in the form of voluntarily formed cooperative arrangements and other transactional structures embedded within the surrounding property infrastructure, which is otherwise left formally unchanged.

These remedial actions do not occur unpredictably. If coordination costs are the "glue" that facilitates uncoordinated entry into a property trap, then these adverse propertization outcomes will be systematically likely to be corrected by innovator populations that exhibit characteristics that depress the coordination costs that would otherwise give rise to and preserve selection errors on the regime path. Truncation actions to halt an incipient property trap, sustain the existing sharing regime, and/or form a novel cooperative arrangement within an existing property regime, necessitate costly contributions, either (i) in the direct case, as a result of lobbying actions to reverse extensions of formal property rights; or (ii) in the indirect case, as a result of litigation risk being incurred by, or innovation gains being forfeited by, failure to adopt and/or vigorously enforce formally available property rights against mutual participants in a voluntary cooperative arrangement. Small number blocs of large participants or a collective trade organization that represents a large number of small participants can alleviate the free-rider

**85.** This optimism characterizes an important minority of the intellectual property literature. *See* WILLIAM M. LANDES & RICHARD A. POSNER, THE POLITICAL ECONOMY OF INTELLECTUAL PROPERTY LAW 18 (2004) (noting that increases in intellectual property protection that adversely affect concentrated economic interests are likely to be resisted effectively); Merges, *Intellectual Property Rights*, *supra* note 16, at 1873-74 (arguing that wholesale capture of legislative decisions concerning the scope of intellectual property law is "not always present" given the capacity of opposing groups to undertake countervailing actions).

problem that discourages individual firms from making these costly contributions toward the collective good in the form of an improved propertization outcome.[86] This proposition follows from a simple application of public goods theory: small numbers and dominant market shares limit the dilution of cooperation gains, which improves the likelihood that any individual participant rationally anticipates that it will receive benefits that are at least commensurate with its contributions to the collective good in the form of an improved propertization outcome.[87] Trade organizations can alleviate free-rider obstacles that would otherwise discourage individually rational contributions to sustain a collectively beneficial sharing regime by coordinating each participant firm's contribution actions and spreading contribution costs among a large pool of individual participants. And even where trade organizations do not exist, profit-seeking entrepreneurs may emerge who self-interestedly devise organizational solutions to alleviate the transactional burdens borne by the adversely affected innovator population, which in turn yields profit streams for the organizational entrepreneur.

These well-known conditions for collective action yield simple differential expectations with respect to the market's self-correction capacities, as anticipated by the STMP thesis. In unconcentrated industries, or in concentrated industries where incumbents are completely integrated entities that make little use of outside inputs, pessimists (and adherents of the ATMP thesis) tend to win out: these markets *are* susceptible to being extensively propertized by idiosyncratic activations of state-provided legal entitlements, resulting in a property trap from which there may be no easy escape. Conversely, in concentrated industries that consist of a small number of large participants, or in unconcentrated industries that consist of a large number of small participants that act collectively through a trade organization, and assuming further that these firms or organizations rely substantially on outside sources for required inputs, optimists (and adherents of the NTMP thesis) tend to win out. To be sure, this is not to deny a meaningful scope of application to the ATMP thesis: there are well-founded theoretical reasons to believe that the market inherently tends toward overpropertization as a result

**86.** The free-rider problem in this context can be summarized as follows: without a credible agreement to enforce individual contributions (or without collateral benefits to induce individual contributions), each firm maximizes its individual payoff by declining to contribute and instead choosing to enjoy the gains generated as a result of other firms' contributions; thus, when no firm contributes, the public good is not funded and all firms are left worse off.

**87.** For the seminal source on the superior lobbying and coordination capacities of small-number and well-organized interest groups, see OLSON, *supra* note 9.

of collective action failure in light of escalating input costs and transaction costs imposed by incremental propertization. This in turn is exacerbated in the case of firms that employ highly integrated research, development, and production processes and therefore make little use of externally sourced technological inputs. But it is critical to observe that these pathological tendencies stand and fall—that is, the relevant innovator population may be substantially resistant to collective action failure—largely as a function of the coordination costs and propertization biases that characterize the relevant innovator population. Where innovators tend to stand on both sides of intellectual property transactions and litigations, which is most likely to occur in markets characterized by cumulative innovation that compels even highly integrated entities to access inputs from outside sources, innovators rationally take into account the expected losses from socially excessive property rights coverage and have incentives to undertake efforts to reduce it. And where coordination costs are low, which is most likely to occur under concentrated market conditions or unconcentrated market conditions subject to collective organization, then privately interested firms inherently tend to have the capacity to accomplish this objective.

*1. Direct Truncation*

The financial services market provides a *possible* illustration of the speed with which a successful sharing regime can rapidly convert into a property regime as a result of the unilateral defection of even a single firm. But that is only half the story. The financial services market *also* provides a possible illustration of the extent to which, and the speed with which, adversely affected innovators can truncate an unwanted propertization outcome through lobbying actions and constrained enforcement activity, which together cuts back the effective level of property rights coverage, which in turn limits litigation risk. This, in turn, can hold back defection rates that would otherwise propel the market into further propertization. Below is the same Figure depicting patenting rates over the past decade in business methods; however, the indicated events now consist of a variety of actions undertaken by financial services firms to *restrain* implementation of formally available property entitlements. By July 1999, exactly twelve months after the *State Street* decision, financial services firms had already achieved enactment of a unique prior user defense, which protects against infringement claims over business method innovations that have been practiced privately but never disclosed to

the public,[88] thereby *directly* reducing the litigation risk from staying outside of the property regime and preserving some of the cost advantage of the sharing regime.[89] In March 2000, the PTO responded to public pressure by introducing a second review process for "class 705" patent applications[90] in order to improve patent quality, which *indirectly* reduced litigation risk by increasing the costs of obtaining patents, thereby reducing anticipated adoption rates, which again preserves some of the cost advantage of the sharing regime. At roughly the same time, Jeff Bezos, CEO of Amazon (the *same* company that had aggressively litigated business method patents during the initial "rush to patent"), floated a proposal to limit the term of business method patents to three to five years and create an opportunity for the public to submit prior art to patent examiners to filter out "bad" business-method patent applications.[91] For purposes of our analysis, this represents an attempt to induce market coordination so as to accrue joint gains from scaling back a collectively injurious propertization outcome.

While the Bezos proposal for a sui generis reduced term for business method patents was never adopted, leading players in the financial services community are currently lobbying for general legislation to relax patent protections[92] and unique legislation that would grant specific immunity from the Data Treasury litigation described above.[93] These same business pressures

88. First Inventor Defense Act of 1999, 35 U.S.C. § 273 (2000).

89. For a similar observation, see Merges, *supra* note 12, at 6.

90. *See* U.S. PATENT & TRADEMARK OFFICE, A USPTO WHITE PAPER: AUTOMATED FINANCIAL OR MANAGEMENT DATA PROCESSING METHODS (2000), http://www.uspto.gov/web/menu/busmethp.

91. *See* Bezos and O'Reilly Spearhead Call for Patent Reform, OReilly.com, March 9, 2000, http://oreilly.com/news/amazon_patents.html.

92. *See* Patent Reform Act of 2009, designated as S.515 (reported with amendments, Apr. 2, 2009) and H.R. 1260 (introduced Mar. 3, 2009). For earlier bills, see Patent Reform Act of 2007, designated as S. 1145 and H.R. 1908 (introduced Sept. 11, 2007). In 2008, financial services companies or representative organizations which were signatories to an open letter sent to members of Congress in support of the legislative reform package included: the Securities Industry and Financial Markets Association; Visa Inc.; and the Financial Services Roundtable (a financial services industry trade group). *See* Letter to The Honorable Harry Reid, Majority Leader, U.S. Senate, and The Honorable Mitch McConnell, Republican Leader, U.S. Senate, Jan. 22, 2008, http://www.sifma.org/regulatory/comment_letters/61653310.pdf.

93. *See* Jeffrey H. Birnbaum, *Lawmakers Move To Grant Banks Immunity Against Patent Lawsuit,* WASH. POST, Feb. 14, 2008, at A22. This provision was included in the Senate version of the 2007 proposed patent reform bill, see *supra* note 92, and has been included in an alternative version of the Senate's 2009 proposed patent reform bill, as introduced by Senator John Kyl (R-AZ). *See* Stephen Albainy-Jenei, *Patent Reform 2009: Still Too Many Competing Interests,*

have apparently been reflected by the Federal Circuit in recent decisions that appear to narrow the scope of *State Street* to methods that are embodied in a particular technological application,[94] culminating in 2008 in the decision in *In re Bilski*.[95] In that decision, the court expressly reconsidered its 1998 decision, in part on the basis of a large number of amicus briefs filed with the court (including a brief by the financial services industry—as well as a brief by the computer and communications industry—urging the court to overrule *State Street* and its progeny).[96] While the court did not entirely repudiate *State Street* and rejected any flat prohibition against business method patents or other patents lacking a physical apparatus, it identified a "machine-or-transformation test" promulgated in older Supreme Court jurisprudence[97] as the principal test for patentable subject matter and suggested that patent claims that involve stand-alone "abstractions" would violate the long-standing prohibition on patenting abstract intellectual concepts.[98] *In re Bilski* (now renamed *Bilski v. Doll*) has now been accepted for review by the Supreme Court, which will have an opportunity to clarify the standard for patentable subject matter in the field of non-technical business methods (and perhaps more generally).[99]

Hence, in the space of ten years and against the background of especially high litigation risks posed by idiosyncratic resource holders, intensive investment by an adversely affected and concentrated innovator population—namely, large firms in the financial services community—has substantially truncated a formally available intellectual property regime and, pending the

Patent Baristas, Mar. 24, 2009, http://www.patentbaristas.com/archives/2009/03/24/patent-reform-2009-still-too-many-competing-interests.

94. *See, e.g.*, Muniauction, Inc. v. Thomson Corp., 532 F.3d 1318 (Fed. Cir. 2008); *In re* Nuijten, 500 F.3d 1346, 1352-57 (Fed. Cir. 2007).

95. 545 F.3d 943 (Fed. Cir. 2008).

96. *See* Brief Amicus Curiae of Computer & Communications Industry Association in Support of Appellee Director of the U.S. Patent and Trademark Office and Urging Affirmance, *In re Bilski*, 545 F.3d 943 (No. 2007-1130); Brief for Financial Services Industry as Amici Curiae in Support of Affirmance, *In re Bilski*, 545 F.3d 943 (No. 2007-1130).

97. *In re* Bilski, 545 F.3d at 954-60. For the leading historical source of this test, see *Gottschalk v. Benson*, 409 U.S. 63 (1972), which was clarified (and narrowed) in *Parker v. Flook*, 437 U.S. 584 (1978). The *Bilski* court explicitly adopted (or readopted) the "machine-or-transformation test" in lieu of the "useful, concrete and tangible result" test that had been set forth by the Supreme Court in *Diamond v. Diehr*, 450 U.S. 175 (1981), and then implemented by the Federal Circuit in *State Street Bank and Trust Co. v. Signature Financial Group, Inc.*, 149 F.3d 1368 (Fed. Cir. 1998).

98. *In re* Bilski, 545 F.3d at 963-64.

99. Bilski v. Doll, 129 S. Ct. 2735 (2009).

Supreme Court's review of *In re Bilski,* now threatens even to cause its near demise. Lobbying actions have been complemented throughout by a policy of constrained adoption and enforcement of financial method patents, whereby each firm contributes to reducing perceived litigation risk by limiting its accumulated stock of patent rights and its exercise of those rights. Consistent with this mutual restraint strategy, large financial services firms generally have only made a relatively modest number of patent applications[100] and have brought many fewer infringement suits under these patents.[101] Litigations to enforce financial method patents have overwhelmingly been brought against asset-rich investment banks, credit card issuers, and/or trading exchanges by small-firm outsiders that typically have no business operations, acquired the relevant patent from a third party, and/or lack the brand capital and other bundled product attributes of a large financial services firm.[102] It may seem curious that firms expend resources to amass even a modest patent inventory while failing to reap the fruits of these expenditures through infringement actions (and taking lobbying actions to *reduce* the value of these entitlements). But it is fully consistent with an effort by incumbent innovators (i) to partially adopt state-provided property entitlements so as to limit litigation exposure to enforcement actions by idiosyncratic holders, but (ii) to refrain from enforcement (and to seek legislative changes that would limit enforcement) in

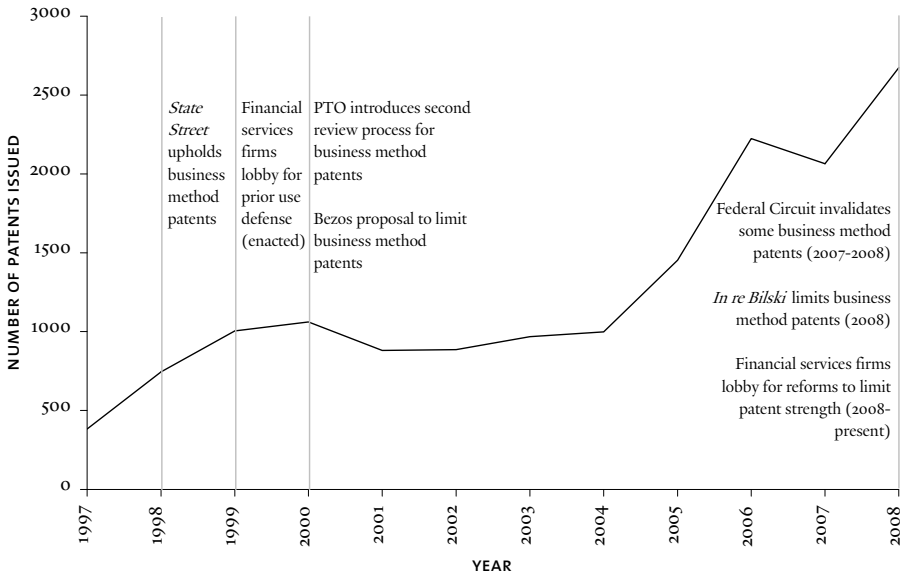
100. *See* Lerner, *Litigation of Financial Innovations*, *supra* note 81, at 11 (noting that, for the period 1976-2003, the leading patentees are mostly information technology companies that apparently patented innovations developed in the course of providing services to clients in the financial services industry). Some firms within the financial services industry do appear to have invested greater efforts in patenting financial method innovations than others. *See* Tamara Loomis, *Express Route*, IP LAW & BUS., Aug. 2005, at 32 (reporting that American Express adopted a more aggressive patenting strategy after having reached a settlement as a defendant in a financial-method patent infringement suit).

101. *See* Lerner, *Litigation of Financial Innovations*, *supra* note 81, at 11-12 (finding that, for the period 1976-2005, patent holding companies are the most frequent plaintiffs in litigation over finance patents); *id.* at 15 ("Patents assigned to individuals are five times more likely to be litigated than those held by public corporations, and about 50% more likely to be so than those held by private firms, which include both smaller operating firms and patent holding companies.").

102. *See id*. at 11-12, 15 (finding that, in the sample of firms that were issued finance patents during 1976-2003, (i) firms with less than two hundred employees had initiated at least one lawsuit per finance patent; and (ii) firms with more than 200,000 employees had *never* initiated a lawsuit to enforce a finance patent). For examples of relevant litigations, see Press Release, eSpeed, Inc., eSpeed and New York Mercantile Exchange Reach Settlement Agreement on Wagner Patent (Dec. 22, 2003), http://www.espeed.com/articles/article20031222.htm (reporting that eSpeed had settled business method a patent suit against the New York Mercantile Exchange for $8 million). I note that eSpeed is an affiliate of Cantor Fitzgerald, a bond brokerage firm that does have an operational business.

order to avoid a collective loss in the form of the transaction cost burdens inherent to a fully deployed property regime.

**Figure 7.**
PROPERTY TRUNCATED (CLASS 705 PATENTS)




*2. Indirect Truncation*

Popular and scholarly commentary widely assumes that certain innovation markets—especially multicomponent markets such as biotechnology, software, and information technology—suffer from thickets of overlapping property rights that restrain and encumber research and development activities, thereby slowing, rather than promoting, innovative output. But this often-repeated statement loses considerable force given that empirical inquiries to identify patent thickets or related "anticommons" effects in these markets have so far failed to confirm or reject any inhibitory effect on innovation activity.[103]

**103.** *See* David E. Adelman, *A Fallacy of the Commons in Biotech Patent Policy*, 20 BERKELEY TECH. L.J. 985, 989-90 (2005) (observing that "anticommons" and related critiques of biotechnology patents are grounded in isolated anecdotes and have not been confirmed by empirical studies); Timothy Caulfield et al., *Evidence and Anecdotes: An Analysis of Human Gene Patenting Controversies*, 24 NAT. BIOTECH. 1091, 1093 (2006) (same); Stuart J.H. Graham & David C. Mowery, *Software Patents: Good News or Bad News?*, *in* INTELLECTUAL

Moreover, these indeterminate (if still preliminary) findings are consistent with the broad sweep of intellectual property history: unambiguous cases of "IP bottlenecks" are few, whereas transactional solutions that solve or preempt actual or potential bottlenecks are abundantly documented.[104] These solutions extend across an impressively broad range of periods and markets, each of which engineers a customized transactional landscape where the surrounding property regime is formally unchanged but is displaced in part by embedded

PROPERTY RIGHTS IN FRONTIER INDUSTRIES: SOFTWARE AND BIOTECHNOLOGY 45, 73 (Robert W. Hahn ed., 2005) (noting that "contentions that increased software patenting somehow 'causes' declines in R & D investment remain unproven") (internal citation omitted); F. Scott Kieff, *On Coordinating Transactions in Intellectual Property: A Response to Smith's* Delineating Entitlements in Information, 117 YALE L.J. POCKET PART 101 (2007), http://yalelawjournal.org/images/pdfs/593.pdf (noting the lack of supporting empirical evidence for the anticommons concept). A number of underlying studies have examined the biotechnology sector. *See* David E. Adelman & Kathryn L. DeAngelis, *Patent Metrics: The Mismeasure of Innovation in the Biotech Patent Debate*, 85 TEX. L. REV. 1677, 1680 (2007) (finding "little evidence that the recent growth in biotechnology patenting is threatening innovation" based on dataset of 52,000 biotechnology patents from January 1990 through December 2004); John P. Walsh, Ashish Arora & Wesley M. Cohen, *Effects of Research Tool Patents and Licensing on Biomedical Innovation*, *in* PATENTS IN THE KNOWLEDGE-BASED ECONOMY 285 (Wesley M. Cohen & Stephen A. Merrill eds., 2003) (finding that, in a sample of seventy interviews, patents on inputs to drug discovery generally have not halted research projects due to potentially conflicting patent claims held by other parties, although there is evidence of some delays in negotiating access to research tools or other valuable information or methodologies); Fiona Murray & Scott Stern, *Do Formal Intellectual Property Rights Hinder the Free Flow of Scientific Knowledge? An Empirical Test of the Anti-Commons Hypothesis* (Nat'l Bureau of Econ. Research, Working Paper No. 11465, 2005) (hypothesizing that anticommons effects would predict a lower citation rate for papers that contained ideas that were subsequently patented and finding evidence of a modest effect). For some studies in the software sector, see John R. Allison & Ronald J. Mann, *The Disputed Quality of Software Patents*, 85 WASH. U. L. REV. 297 (2007), which finds that software patents vary in quality and value and as a group appear to be of higher quality and value than the average patent, based on a dataset of 20,000 computer industry patents; Robert P. Merges, *Software and Patent Scope: A Report from the Middle Innings*, 85 TEX. L. REV. 1627, 1628 (2007), which finds that previously expressed concerns that patent protection would discourage software innovation have been contradicted by continuing robust industry performance; and Robert P. Merges, *Patents, Entry and Growth in the Software Industry* (Univ. of Cal. Berkeley Sch. of Law Working Paper, 2007), which finds that patent effort by incumbent software firms correlates closely with indicators of market success and that entry rates in the software industry have not declined as patentability has increased.

**104.** Professor Robert Merges has provided some of the leading scholarship for both parts of this statement. *See* Merges, *supra* note 61 (documenting transactional solutions whereby private parties lower the costs of licensing and enforcing large pools of intellectual property rights); Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839 (1990) (documenting cases where patent disputes apparently delayed development of early aircraft and radio technologies and describing some industry-generated solutions).

cooperative arrangements that pool knowledge assets among various firms, thereby effectively lifting property rights protections among the participant group and preserving in part the low transaction cost structure of a sharing regime. Historical and contemporary arrangements include: tens of patent pools that covered a large number of manufacturing industries in the pre-World War II era;[105] thousands of strategic alliances and knowledge-cooperative arrangements in the biotechnology industry between private firms and academic or other not-for-profit entities, including the formation of public or quasipublic databases for biological and genetic materials that are freely or substantially accessible to a large pool of academic and commercial users (for example, Merck Gene Index, SNP Consortium, and GenBank);[106] widespread cross-licensing, constrained enforcement, and, more recently, research and development consortia that characterize the semiconductor industry;[107] and patent-pooling arrangements in the consumer electronics and telecommunications industries, including the "MPEG LA" pools that cover patents relating to essential data-compression and other technology standards, involve hundreds of patent holders and thousands of patents, and cover hundreds of millions of dollars in worldwide sales.[108]

105. *See* Robert P. Merges, *Institutions for Intellectual Property Transactions: The Case of Patent Pools*, *in* EXPANDING THE BOUNDARIES OF INTELLECTUAL PROPERTY: INNOVATION POLICY FOR THE KNOWLEDGE SOCIETY, *supra* note 2, at 123, 135-39; Merges, *supra* note 61, at 1342-52.

106. For a comprehensive review of these knowledge-cooperative arrangements, see Nadine Roijakkers & John Hagedoorn, *Inter-Firm R&D Partnering in Pharmaceutical Biotechnology Since 1975: Trends, Patterns, and Networks*, 35 RES. POL'Y 431 (2006). For data on strategic alliances and similar arrangements in biotechnology, see David B. Audretsch & Maryann P. Feldman, *Small-Firm Strategic Research Partnerships: The Case of Biotechnology*, 15 TECH. ANALYSIS & STRATEGIC MGMT. 273 (2003). For additional discussion of cooperative arrangements in the biotechnology sector, see Jonathan M. Barnett, *Cultivating the Genetic Commons: Imperfect Patent Protection and the Network Model of Innovation,* 37 SAN DIEGO L. REV. 987, 1015-21 (2000); Peter Lee, *Contracting to Preserve Open Science: Consideration-Based Regulation*, 58 EMORY L.J. 889, 915-16 (2009); and Robert P. Merges, *A New Dynamism in the Public Domain*, 71 U. CHI. L. REV. 183, 186-91 (2004).

107. For extensive discussion, see *infra* Section III.B.

108. See information found at MPEG LA Website, http://www.mpegla.com (last visited Sept. 5, 2009). For further discussion, see DAVID J. TEECE, MANAGING INTELLECTUAL CAPITAL: ORGANIZATIONAL, STRATEGIC, AND POLICY DIMENSIONS 194-98 (2000); and Anne Layne-Farrar & Josh Lerner, *To Join or Not To Join: Examining Patent Pool Participation and Rent Sharing Rules* (Nat'l Bureau of Econ. Research, Working Paper No. 15,061, 2009), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=945189. I note that some "MPEG" pools operate as simple cost-effective solutions to licensing large pools of patents, akin to the performance-rights licensing organizations in the content industries (for example, BMI and ASCAP), which does not alter the formal propertization outcome; however, others appear to permit access to standard technologies by competitors for purposes of facilitating

The impressive diffusion and variety of cooperative solutions to excessive propertization outcomes, and the resulting effective recalibration of state allocated legal entitlements, broadly track the limited optimism of the STMP thesis: an adversely affected innovation market that does not suffer from high coordination costs or a skewed propertization bias is unlikely to be stuck with an excessive property regime it does not want or need. This qualified optimism in the self-correction capacities of certain innovation markets relies on a straightforward profit-maximization principle: *subject to coordination cost obstacles, any transaction cost inefficiency as a result of excessive propertization inherently induces rational investments by adversely affected innovators to accrue the gains from correcting it.* Even in the otherwise adverse case where no individual firm has sufficient interest or resources to undertake corrective action to scale back an excessive propertization outcome, third-party intermediaries may have a rational profit incentive to do so (something which has occurred in the case of the long-established American Society of Composers, Authors, and Publishers (ASCAP) and Broadcast Music, Inc. (BMI) organizations in the music industry and the newly formed "MPEG LA" patent pools in the consumer electronics industry). Following this guardedly optimistic view, even complex innovation markets that are inherently susceptible to a property trap that entrenches unneeded intellectual property protections will rationally engage in some meaningful level of mutually beneficial Coasean bargaining, which in turn yields cooperative mechanisms that trade off innovation gains against transaction costs and associated losses. These cooperative arrangements are fully consistent with the underlying social cost-benefit rationale that lies behind the Demsetz model of rights formation (and the Coasean model of rights reallocation), but *working in reverse*[109]: competing firms partially abandon or otherwise constrain a property regime in order to enter into

product development, which does diverge materially from formally allocated entitlements. For detailed discussion, see Layne-Farrar & Lerner, *supra*.

109. For discussions of a similar reversal in the classic sequence anticipated by Demsetz, see Merges, *supra* note 106, at 200-01, which argues that "property-preempting investments" in software, biotechnology, and cultural markets appear to reverse Demsetz's proposed correlation between an increase in property values and an increase in property rights, insofar as increases in the value of the relevant asset class apparently trigger voluntary abandonment of property rights. Note that, whereas Merges primarily attributes the voluntary abandonment of property rights for competitive advantage to an increase in the value of the underlying asset, *id.*, I attribute this phenomenon entirely to an increase in the transaction costs of sustaining participation in the property regime relative to the innovation gains that could be accrued by abandoning the regime. That is consistent with the Demsetz thesis, which provides that property rights will increase as a function of increasing value, subject to the administration and enforcement costs of doing so. *See supra* notes 48-49 and accompanying text.

mutually beneficial arrangements that generate collective gains in the form of reduced transaction costs and associated innovation gains.

### *C. Why "Too Much" Property Often Does Not Last*

The STMP thesis—and, in particular, the expectation that individually rational innovators will sometimes take actions to adjust collectively irrational propertization outcomes—directly anticipates a real-world scenario of substantial importance largely overlooked by the intellectual property literature: large resource holders actively and successfully resist the imposition of novel intellectual property protections, actively lobby for the withdrawal, reversal, or dilution of intellectual property protections, and, most strikingly, regularly forfeit large pools of knowledge assets to the public domain. The essential reason behind this otherwise curious behavior is simple: large resource holders do not simply seek to maximize initial innovation gains, as various versions of the ATMP thesis assume or imply; rather, they self-interestedly seek to maximize *the cumulative stream of initial plus subsequent innovation gains, net of transaction costs*, as the STMP thesis correctly observes.[110] Assume that a large firm is a repeat player that tends to stand on both sides of intellectual property transactions and litigations with roughly equal frequency[111] (or more precisely, tends over time to have roughly equal

110. This is not the exclusive motivation for giving away knowledge assets that are, or could be, protected by patents or other entitlements. Most obviously, firms may forfeit patentable assets in order to preempt competitors from patenting those assets, for which "vanity journals" are used in order to establish a prior art record. Some scholars have argued that firms will prefer to "give away" private technology in order to induce follow-on innovation that increases the value of the original innovation. *See* Oren Bar-Gill & Gideon Parchomovsky, *The Value of Giving Away Secrets*, 89 VA. L. REV. 1857 (2003) (describing the increasing tendency among firms to publish, rather than patent, valuable private knowledge, which is attributed to a rational interest in credibly committing to share surplus with follow-on innovators). In the fashion context, I and co-authors have argued that luxury apparel firms prefer incomplete protections against third-party imitation—that is, to effectively "give away" a portion of any season's revenues on a winning product—in order to accrue "runner-up" awards in other seasons where the firm misjudges the winning style outcome. *See* Jonathan M. Barnett, Gilles Grolleau & Sana El Harbi, *The Fashion Lottery: Cooperative Innovation in Stochastic Markets*, 39 J. LEGAL STUD. (forthcoming 2010).

111. This assumption has empirical grounding. Based on a dataset of U.S. public firms involved in 20,522 patent lawsuits during the period 1987-1999, Professors James Bessen and Michael Meurer have estimated that the hazard of being an alleged patent infringer has been slightly less than being a patent litigant (where hazard is calculated as the sample mean rate of litigation per firm divided by the sample mean deflated R&D expenditure). *See* James Bessen & Michael J. Meurer, *The Patent Litigation Explosion* 17-18 (Boston Univ. Sch. of Law Working Paper Series, Law & Econ. Working Paper No. 05-18, 2005),

economic values at stake as, respectively, seller/plaintiff or buyer/defendant). It will then rationally assign roughly equal weight to each component of the net social product generated by intellectual production—innovation gains and transaction cost losses attendant to increased propertization—which, in turn, implies that it will demand property rights approximately at a level that mimics the social interest in maximizing the social product yielded by innovation investment. Contrary to natural intuitions, it may therefore be the case that the *largest* resource holders will tend to have the *strongest* incentives to relax intellectual property protections where incremental transaction costs and associated innovation losses race ahead of incremental innovation gains, thereby self-interestedly acting to expand the public domain in at least partial consistency with the social interest. Further challenging natural intuitions (and setting aside distributive considerations), this implies in turn that individual end users and individual inventors will tend to have the *weakest* incentives to demand socially compatible levels of intellectual property protections. End users will demand too little property (by underweighting initial innovation gains and overweighting transaction costs) while individual inventors will demand too much property (by overweighting initial gains and underweighting transaction costs and associated innovation losses), especially (as may typically be the case) if these firms or individuals are not repeat players.[112]

http://ssrn.com/abstract=831685. Importantly, these data show that a public firm's risk of being an alleged patent infringer (measured relative to R&D spending) has risen sharply during the subject period (a seventy percent increase), *id.* at 18, which would in turn be consistent with the fact that (as I discuss shortly) these firms (in some industries) are the principal proponents behind proposed reforms to relax patent protections. Note that if hazard is measured alternatively as the rate of litigation per patent, then the hazard rate does not change significantly during the subject period in general and behaves differently in different industries. *See id.* at 33.

**112.** It should be noted that the "propertization bias" of individual inventors and small firms may have some countervailing efficiency benefits, to the extent that either (i) small firms are uniquely situated to generate certain types of innovations, or (ii) large firms have differential access to substitutes for intellectual property (in which case, reducing intellectual property protection necessarily protects incumbents against entry). For further discussion, see Jonathan M. Barnett, *Is Intellectual Property Trivial?*, 157 U. PA. L. REV. 1691, 1726-29, 1736-37 (2009); and Barnett, *supra* note 44, at 1285-98. That in turn raises the broader question (outside the immediate scope of this Article) of whether "second-best" considerations would sometimes recommend some level of "excessive" propertization in order to offset the inefficiencies resulting from the concentrated market conditions that otherwise facilitate private-market efforts to reduce the transaction cost losses attendant to an actively deployed property regime. Put differently: we may face an inherent choice between (i) a heavily propertized market with high transaction costs and associated losses but lower barriers for small-firm entry, and (ii) a lightly propertized market with low transaction costs and associated losses but higher barriers for small-firm entry.

The surprising proposition that large firms may sometimes act as the strongest bulwark against too much property accounts not only for the widespread distribution of knowledge sharing arrangements among direct competitors in technology markets but also for even bolder and more curious varieties of rational forfeiture of knowledge assets. Self-interested efforts by large firms to reduce transaction costs (and thereby accrue resulting innovation gains) can account for the surprisingly widespread practice whereby firms with rich innovation portfolios make substantial giveaways of knowledge assets, tolerate infringement, and advocate relaxed forms of intellectual property protection (which is functionally equivalent to forfeiting exclusivity over some existing and future pool of knowledge assets). Consider, in chronological order:

(1) *The Automotive Technology Giveaway*. Starting in 1911, virtually all U.S. automobile manufacturers automatically cross-licensed patented technologies at a zero royalty rate. In 1938, Ford Motor Company reported that it offered its patents to "any applicant" at no charge and declined as a matter of policy to bring enforcement actions even against parties that used its technology without obtaining the zero-royalty license.[113] Similar policies have continued in the automotive industry formally and informally through the present day[114] (as indicated in part by its relatively low incidence of patent litigation[115]).

(2) *The AT&T/Bell Labs Giveaway*. Starting in 1952, AT&T made available to all applicants its transistor and related patents at low royalty rates of 0 to 2% of sales (subject to a cross-license obligation in some cases), which provided the foundation for the semiconductor industry. The policy was rendered mandatory by a government consent decree in 1956; however, AT&T reportedly

113. *See Investigation of Concentration of Economic Power: Hearings Before the Temporary National Economic Comm.*, 75th Cong. 257-58 (1938) (testimony of Edsel Ford, President, Ford Motor Co., and testimony of I. Joseph Farley, Patent Counsel, Ford Motor Co.) [hereinafter *Ford Testimony*].

114. *See* Merges & Nelson, *supra* note 104, at 890 (noting the current practice in the automotive industry of "relatively automatic cross licensing" of patents).

115. *See* John R. Allison et al., *Valuable Patents*, 92 GEO. L.J. 435, 446, 472 (2004) (finding that patents in automotive, semiconductor, and chemicals industries are litigated less frequently than in all other industries based on sample population of patents issued between June 1996 and May 1998).

*exceeded* the decree's requirements in its efforts to disseminate transistor technology and related know-how to licensees.[116]

(3) *The IBM Know-How Giveaway*. From 1958 through 1998, IBM, through its Technical Disclosure Bulletin, released substantial know-how concerning unpatented technical improvements that it had developed, which in turn have been cited as prior art in 48,000 patent applications.[117]

(4) *The Corporate Research Giveaway*. Technology firms contribute to the public domain large amounts of valuable knowledge, either in scientific journals or in vanity trade journals established precisely for this purpose and distributed among research laboratories.[118] Between 1991 and 2000, IBM and AT&T were the first and second most prolific publishers of papers in computer science, AT&T was the most prolific publisher of papers in physics, and IBM was one of the five most prolific publishers of papers in physics.[119]

(5) *The Financial Information Giveaway*. The Bloomberg Corporation, one of the world's leading providers of data to the financial markets, has vigorously (and successfully) resisted the imposition of intellectual property protection[120] precisely because it is a heavy user of informational inputs and rationally anticipates that enhanced propertization would be unlikely to generate internalization gains in excess of internalization costs.

(6) *The Information Technology Giveaway*. In the information technology markets, major firms regularly contribute patented technology to industry standard-setting organizations, which then take ownership

116. *See* Richard C. Levin, *The Semiconductor Industry*, *in* GOVERNMENT AND TECHNICAL PROGRESS: A CROSS-INDUSTRY ANALYSIS 9, 76-77 (Richard R. Nelson ed., 1982).

117. *See* Scott Baker & Claudio Mezzetti, *Disclosure as a Strategy in the Patent Race*, 48 J.L. & ECON. 173 (2005).

118. *See* TEECE, *supra* note 108, app. A., § A.3.3; Bar-Gill & Parchomovsky, *supra* note 110, at 1857-58.

119. *See* Julien Pénin, *Open Knowledge Disclosure: An Overview of the Evidence and Economic Motivations*, 21 J. ECON. SURVS. 326, 329 (2007) (citing a survey by *Science Watch*). In 1991, industry researchers were responsible for *one-sixth* of the scientific and technical literature in chemistry and physics and *one-fourth* of the scientific and technical literature in engineering and technology. *See* Paula E. Stephan, *The Economics of Science*, 34 J. ECON. LIT. 1199, 1210-11 (1996).

120. *See Database and Collections of Information Misappropriations: Joint Hearing on H.R. 3261 Before the Subcomm. on Courts, the Internet, and Intellectual Property of the H. Comm. on the Judiciary and the Subcomm. on Commerce, Trade, and Consumer Protection of the H. Comm. on Energy and Commerce*, 108th Cong. 50 (2003) (statement of Thomas J. Donohue, President and Chief Executive Officer, Chamber of Commerce).

of the technology or require that the contributing firm license the technology to organization members on a royalty-free or "reasonable and nondiscriminatory" basis (and sometimes even compels licensing to nonmembers that use the standard).[121]

(7) *The Biotech Giveaway*. Following the advent of case law that strengthened patent protection for certain genetic material[122] and the subsequent exploitation of these rights in the biotechnology industry, large pharmaceutical companies have sponsored the creation of public access databases for certain genetic and other biological material. For example, Merck & Co. has sponsored, in collaboration with Washington University, the Merck Gene Index for expressed gene sequence tags, and thirteen major pharmaceutical companies have sponsored the SNP Consortium, which provides private funding for a project dedicated to developing a "next-generation" map of the human genome in coordination with various government health ministries and academic research institutes.[123]

(8) *The Proprietary Software Giveaway*. In 2005, IBM, Sun, and Nokia issued pledges not to enforce their patents against open source software developers.[124] In the same year, IBM and other major technology companies agreed with leading universities on

121. *See* Mark A. Lemley, *Intellectual Property Rights and Standard-Setting Organizations*, 90 CAL. L. REV. 1889, 1904-06 (2002) (reviewing rules and bylaws adopted by dozens of standard setting organizations, mostly in the computer networking and telecommunications industries, with respect to ownership and licensing of patents and other intellectual property rights contributed to those organizations).

122. For leading decisions, see *Diamond v. Chakrabarty*, 447 U.S. 303 (1980), which upheld a patent on a genetically engineered microorganism; and *Amgen, Inc. v. Chugai Pharmaceutical Co.*, 927 F.2d 1200 (Fed. Cir. 1991), which upheld a patent on purified and isolated DNA sequence encoding a red blood cell-stimulating protein.

123. For information on the SNP Consortium, see About the International HapMap Project, http://snp.cshl.org/abouthapmap.html (last visited Sept. 5, 2009); and SNP Fact Sheet, http://www.ornl.gov/sci/techresources/Human_Genome/faq/snps.shtml#whoare (last visited Sept. 5, 2009). For information on the Merck Gene Index, see Press Release, Merck & Co., First Installment of Merck Index Data Released to Public Databases (Feb. 10, 1995), http://www.bio.net/bionet/mm/bionews/1995-February/001794.html. For further description of these arrangements, see Lee, *supra* note 106, at 905, 915-16; and Merges, *supra* note 106, at 187-88.

124. *See* Ronald J. Mann, *Commercializing Open Source Software: Do Property Rights Still Matter?*, 20 HARV. J.L. & TECH. 1, 29 (2006).

guidelines to permit the free availability of software developed in "precompetitive" industry-academic collaborative projects.[125]

(9) *The Open-Source Software Giveaway*. In the open-source software market, where applications are released largely without copyright protections against third-party usage and distribution (subject to certain contractual restrictions), substantial funding (roughly estimated at $1 billion per year) and hundreds of technical staff are now supplied by proprietary software firms. Some of these firms are participants in the Open Invention Network, a nonprofit entity that patents, or acquires patents to, open-source technologies and then contributes them into an open access innovation pool.[126]

Consistent with this historical pattern of voluntary forfeitures by large holders of knowledge assets, the country's leading information technology and financial services firms, acting through a trade group known as the Coalition for Patent Fairness,[127] are now pushing for patent reforms that would increase the difficulty in obtaining patents, reduce the difficulty in contesting patents, and lower the damages for which infringers are liable.[128] These "publicly interested" efforts to constrain intellectual property protection jar with the familiar observation of rent-seeking actions by large-firm incumbents to push through socially excessive levels of intellectual property protection and enclose the public domain, all of which is purported to operate consistently to the public detriment while enriching the pockets of the relevant corporate treasury. Such cases certainly exist and have been documented in extensive detail.[129] Indeed, these pathological cases are fully anticipated by the theoretical

125. *See* Steve Lohr, *Guidelines Set on Software Property Rights*, N.Y. TIMES, Dec. 19, 2005, at C6; IBM University Relations, http://www.ibm.com/university (last visited Sept. 5, 2009).

126. *See* Mann, *supra* note 124, at 20, 31 n.129. For extensive discussion, see Barnett, *supra* note 38, at 57-69. For further discussion of the Open Invention Network, see *infra* note 144 and accompanying text.

127. For more detailed information, see Coalition for Patent Fairness, http://www.patentfairness.org (last visited Sept. 5, 2009).

128. *See supra* note 92. The reforms are opposed by individual inventors and venture capitalist investors that commonly invest in small firms as well as, most adamantly, the pharmaceutical and biotechnology industries.

129. On standard accounts of the political economy of copyright and patent law, see *supra* note 59. On the political economy of trademark law, see Clarisa Long, *The Political Economy of Trademark Dilution*, *in* TRADEMARK LAW AND THEORY: A HANDBOOK OF CONTEMPORARY RESEARCH 132 (Graeme B. Dinwoodie & Mark D. Janis eds., 2008), which documents that large corporate interests supported legislative expansion of trademark law to cover dilution claims, but federal courts constrained the reach of those expansions and these court decisions were only partially reversed by legislative amendments.

discussion above, which contemplates a strong propertization bias in the case of highly integrated entities that make little use of outside sources to access required inputs. It may therefore be no accident that some of the most vigorous articulations of the too much property thesis are advanced with respect to the entertainment and other content-dependent industries, where there is a reasonable case that the most dominant firms have rich copyright estates that necessitate little recourse to outside sources for creative inputs, thereby implying a skewed bias in favor of excessive propertization levels,[130] and adversely affected groups tend to be highly dispersed, thereby implying a weak ability to undertake any corrective action. The extent to which the entertainment industry as a whole exhibits a skewed propertization bias, and the extent to which adversely affected groups—which broadly include users, (some) creators, hardware manufacturers, and distribution intermediaries—have capacities to correct excessive propertization outcomes, both through legal and extralegal strategies, are open and complex empirical questions deserving of further inquiry.[131]

130. There may be other reasons why, relative to other industries, entertainment firms are both more sensitive to the innovation gains and less sensitive to the transaction costs attendant to increased intellectual property rights. First, these firms generally operate in a capital-intensive "hits market," which implies especially high requirements for copyright protection given a large "appropriability gap" between creation costs (which must take into account the costs of creation across the large number of failed projects) and imitation costs, which can be close to negligible depending on the quality of then-existing reproduction technologies. Second, while these firms produce multi-component products akin to the information technology sector, firms can limit exposure to the transaction costs of a property rights system through (i) "work for hire" contracts (which preempt copyright infringement and "joint works" claims by freelance contributors); (ii) "errors and omissions" insurance against copyright infringement suits; and (iii) regular refusal to review unsolicited submissions (which protects against copyright infringement and common-law misappropriation claims). These are all standard practices at Hollywood studios. Interview with David Fierson, Senior Vice President, Alcon Entm't, in L.A., Cal. (Nov. 20, 2009). On studios' reluctance to review unsolicited manuscripts, see Igor Dubinsky, *The Race to the Box Office Leads to Cinematic Déjà Vu: Modifying Copyright Law To Minimize Rent Dissipation and Copyright Redundancy at the Movies*, 29 WHITTIER L. REV. 405, 411 (2007).

131. Note that the conventional view assumes that adversely affected populations in entertainment and other content markets lack any feasible means by which to influence propertization outcomes or otherwise reduce transaction cost burdens (which in turn would support the standard normative view that copyright persists at excessive levels in these markets). Some preliminary observations suggest a murkier picture. Consider: (i) users can influence propertization outcomes by mass infringement and through conventional lobbying by collective organizations such as library associations and higher education institutions; (ii) hardware manufacturers can influence propertization outcomes by selling devices that lower the costs of user infringement; and (iii) distribution intermediaries can influence propertization outcomes by taking greater or lesser precautions against user infringement. Moreover, individual creators exercise leverage in the movie and television

What *is* quite certain, however, is that a large number of economically critical markets—including the information technology, software, database, financial services, and biotechnology markets—are not *always* pathological. Specifically, large firms in these markets have periodically made impressive undertakings to limit the coverage and strength of formal intellectual property rights and have done so precisely in newly propertized innovation markets that are widely claimed to suffer from too much property.

Following the one-sided view of the ATMP thesis, and the distributive critique that presumptively casts doubt on most (if not all) propertization outcomes, these recurrent attempts by large resource holders (often necessitating substantial dollar investments) to cut back intellectual property coverage are difficult to explain. Why would IBM, the world's largest patent holder with over $1 billion a year in royalty income from its patent portfolio,[132] consistently lobby to secure legislative and judicial actions (including repeatedly filing briefs in recent Supreme Court and Federal Circuit patent cases in favor of relaxed patent protections[133]) that would limit its ability to obtain and defend patents and thereby *reduce* the value of its portfolio and associated licensing income? Why would Apple, Cisco Systems, Hewlett Packard, Intel, and Microsoft (just to name a few) all do roughly the same?

industries through trade guilds, and collective clearance organizations have largely solved transaction cost obstacles in performance rights over recorded musical works through associations such as BMI and ASCAP. *See* Merges, *supra* note 61, at 1328-40. More recently, some individual creators have adjusted propertization outcomes to a limited extent through "Creative Commons" licenses that waive certain copyright protections. In short, there is a rich mix of constituencies and strategies that imply a complex balance of power, which, without further analysis, may not immediately support the standard inference of excessive propertization.

132. *See* Brian Bergstein, *IBM Filing Seeks Patent for Patent-Licensing Process*, HOUS. CHRON., Oct. 24, 2007, at 7.

133. *See* Brief of Amicus Curiae International Business Machines Corp. in Support of Neither Party, KSR Int'l Co. v. Teleflex, Inc., 550 U.S. 398 (2007) (No. 04-1350) (arguing against the Federal Circuit's standard for determining non-obviousness and in favor of a standard that would make it easier for PTO to reject combination patent applications); Brief of International Business Machines Corp. as Amicus Curiae in Support of Neither Party, Lab. Corp. of Am. Holdings v. Metabolite Labs, Inc., 548 U.S. 124 (2006) (No. 04-607) (arguing in favor of bolstering the "useful application" requirement that would probably bar purely nontechnical business-method patents); Brief of International Business Machines Corp. as Amicus Curiae in Support of Neither Party, eBay, Inc. v. MercExchange, L.L.C., 547 U.S. 388 (2006) (No. 05-130) (arguing against the Federal Circuit's automatic standards for permanent injunctions and in favor of traditional standards that permit greater use of equitable discretion); Brief of Amicus Curiae International Business Machines Corp. in Support of Neither Party, *In re* Bilski, 545 F.3d 943 (Fed. Cir. 2008) (No. 2007-1130) (urging the Federal Circuit to narrow standard of patentability under *State Street* so as to exclude abstract nontechnological methods).

Each of these firms individually holds thousands of patents but files, or participates in industry associations[134] that regularly file, amicus briefs recommending outcomes that would relax patent protections[135] and, as noted above, actively lobbies for currently pending reforms that would generally make it harder to obtain patents, easier to contest patents, and lower damages for patent infringement.[136]

Failure to explain what facially appear to be irrational giveaways of substantial proportions is a major shortcoming. This explains why conventional intellectual property commentary sometimes misinterprets pro-reform lobbying actions by the high technology industry as a "surprising" turnaround in strategy. Not at all. This IP-resistant strategy is *consistent* with past positions taken by large firms in cumulative innovation markets. In 1938, the CEO of Ford Motor Company, together with his legal counsel, testified before a U.S. Senate committee in support of proposed reforms that would *increase* the difficulty of obtaining and renewing patents, a position fully consistent with Ford's then publicly stated policy of open licensing and nonenforcement of patents.[137] Ford and its automotive peers in the 1930s and IBM and its information technology peers today are far from non sequiturs. These voluntary truncations and forfeitures of property rights protections recur periodically as innovator populations recalibrate runaway propertization outcomes from time to time. Today the IP resistance of large incumbents in

134. These trade and lobbying groups include most notably the Business Software Alliance, the Software and Information Industry Association, the Computer and Communications Industry Assocation, and, as noted earlier, the Coalition for Patent Fairness. For further information, see Business Software Alliance, http://www.bsa.org (last visited Sept. 5, 2009); Coalition for Patent Fairness, http://www.patentfairness.org (last visited Sept. 5, 2009); Computer & Communications Industry Association, http://www.ccianet.org (last visited Sept. 5, 2009); and Software & Information Industry Assocation, http://www.siia.net (last visited Sept. 5, 2009).

135. See *supra* note 96 and *infra* notes 140-142. For other examples in the widely followed litigation of *KSR International Co. v. Teleflex, Inc.*, 550 U.S. 398 (2007), see Brief for Amicus Curiae Computer & Communications Industry Ass'n in Support of Petitioner, *Teleflex*, 550 U.S. 398 (No. 04-1350), which urges the Court to adopt a standard that would make it easier for the defendant to contest the nonobviousness of a patent; Brief of the Business Software Alliance as Amicus Curiae in Support of Petitioner, *Teleflex*, 550 U.S. 398 (No. 04-1350), which urges the same; and Brief of Intel Corp. and Micron Technology, Inc. as Amici Curiae in Support of Petitioner, *Teleflex*, 550 U.S. 398 (No. 04-1350), which urges the same.

136. *See supra* note 128. On the involvement of the information technology industry in the lobbying process, see Kim Hart, *Patent Reform Bill Introduced in Congress Today*, WASH. POST, Mar. 3, 2009, http://voices.washingtonpost.com/posttech/2009/03/patent_reform_bill_introduced.html.

137. *See Ford Testimony*, *supra* note 113, at 282.

technology-based industries is targeted most vigorously at patent holding companies (known pejoratively as "trolls"), which are widely portrayed as acquiring patents for the purpose of extracting hold-up payouts from cash-rich firms faced with the threat of a shutdown injunction and treble damages in the case of an adverse judgment.[138] Consistent with the STMP thesis, these firms have invested efforts in lobbying for legislative reforms to the patent statute[139] and, as noted above, filing amicus briefs in a recent series of high-profile patent litigations, in each case advancing positions that limit a patent holder's ability to prevail and/or win damages in an infringement suit. Those litigations have resulted in decisions that advance this objective considerably, most notably making it much harder for a nonpracticing patent holder to obtain injunctive relief even after a finding of validity and infringement (thereby neutralizing the shutdown threat),[140] making it easier to contest the validity of a patent on obviousness grounds,[141] and making it harder for a patent holder to show

138. This phenomenon is most vividly illustrated by the 2006 settlement concerning the Blackberry device, where Research In Motion Ltd. settled an infringement claim for $612.5 million in the face of a threatened injunction that would have shut down the Blackberry system. *See* Associated Press, *Settlement Reached in Blackberry Patent Case*, MSNBC, Mar. 3, 2006, http://www.msnbc.msn.com/id/11659304. Empirical results are complex as to the extent to which non-practicing patent holders actually drive patent litigation, which appears to vary considerably across technology and patent characteristics. *See* John R. Allison, Mark A. Lemley & Joshua Walker, *Extreme Value or Trolls on Top? The Characteristics of the Most-Litigated Patents*, 25 fig.2, 26 tbl.5A (Stanford Pub. Law Working Paper No. 1407796, 2009), http://ssrn.com/abstract=1407796. For policy-oriented commentary on the patent troll issue, see John M. Golden, *"Patent Trolls" and Patent Remedies*, 85 TEX. L. REV. 2111 (2007); and Mark A. Lemley & Carl Shapiro, *Patent Holdup and Royalty Stacking*, 85 TEX. L. REV. 1991 (2007). Note that I am not expressing any view as to whether the conventional portrayal of patent holding companies is an accurate characterization of these entities, at least in the typical case.

139. *See supra* note 128 and accompanying text.

140. I am referring both to (i) the Supreme Court's decision in *eBay Inc. v. MercExchange, L.L.C.*, 547 U.S. 388 (2006), which held that a permanent injunction cannot automatically issue against a defendant following a finding of validity and infringement (rather, it is subject to a multifactor balancing test); and (ii) the lower court case law that has subsequently applied *eBay* such that direct competitors are almost always entitled to an injunction following a finding of validity and infringement whereas indirect competitors are almost always not so entitled. *See* Golden, *supra* note 138, at 2113-14. The Business Software Alliance filed a brief in the landmark Supreme Court case of *eBay, Inc. v. MercExchange, L.L.C.*, successfully arguing against the Federal Circuit's "automatic" injunction standard in patent infringement cases. *See* Brief of Business Software Alliance et al. as Amici Curiae in Support of Petitioners, *eBay*, 547 U.S. 388 (No. 05-130).

141. *See* KSR Int'l Co. v. Teleflex, Inc., 550 U.S. 398 (2007) (instructing that the stringent teaching-suggestion-motivation test established by the Federal Circuit for showing obviousness was too rigid, and that courts should interpret evidence holistically to

willful infringement (which would entitle it to treble damages).[142] As a minor complement to these lobbying efforts, large firms have formed nascent transactional arrangements intended to protect against the "patent troll" threat; as noted previously,[143] a consortium of leading technology companies has launched the Open Invention Network, which seeks to acquire a portfolio of critical patents to be made available at no cost to any firm that agrees not to assert its patents against Linux open source software developers.[144]

The STMP thesis fully anticipates these strategic actions by dominant IP-rich firms to roll back intellectual property protections in the face of third parties' idiosyncratic adoption and enforcement practices: long-term industry players rationally seek to constrain property rights protections in order to maximize the cumulative stream of innovation gains net of transaction costs. To achieve this objective, these firms undertake lobbying, adoption, and/or enforcement actions. They also form various transactional arrangements,

determine whether or not the subject matter of a patent was obvious, taking into account existing knowledge together with technological developments and market demand in the relevant field).

142. *See In re* Seagate Tech., L.L.C., 497 F.3d 1360 (Fed. Cir. 2007) (enhancing the standard by which patentholder must establish objective recklessness in order to show willful infringement, which triggers treble damages). The Business Software Alliance filed a brief urging the court to reverse the lower court's ruling that failure to seek opinion of counsel with respect to likelihood of infringement can support a finding of willful infringement. *See* Brief for the Business Software Alliance as Amicus Curiae Supporting Defendant-Appellant Qualcomm Inc. and Supporting the Petition for Rehearing En Banc 1-2, Broadcom Corp. v. Qualcomm, Inc., 543 F.3d 683 (Fed. Cir. 2008) (No. 2008-1199, -1271, -1272), *available at* http://www.appellate.net/briefs/BSA_Brief_final.pdf (last visited Sept. 5, 2009).

143. *See supra* note 126.

144. *See* Roger Parloff, *A No-Fly Zone To Protect Linux from Patent Trolls*, CNNMoney, Dec. 8, 2008, http://features.blogs.fortune.cnn.com/2008/12/08/a-no-fly-zone-to-protect-linux-from-patent-trolls. Members include IBM, Novell, NEC, Philips and Sony. Fifty companies have entered into reciprocity agreements with the Open Invention Network, including Oracle and Google. For further information, see Open Invention Network, http://www.openinventionnetwork.com (last visited Sept. 5, 2009). Nascent transactional solutions may also emerge from outside the affected population of patent holders. Most recently, the RPX Corporation, a for-profit firm, has acquired a portfolio of critical patents, which it promises not to litigate and licenses on a fixed fee basis to subscribing firms that wish to retire potentially harmful patents. *See* Complete Alignment of Interests Between RPX and Its Members, http://www.rpxcorp.com/svc_howitworks.html (last visited Sept. 5, 2009). Existing licensees include IBM, LG, Cisco, Philips, and Samsung. *See* Press Release, RPX Corporation, Eleven Technology Companies Join RPX in First Five Months (Mar. 31, 2009), http://www.rpxcorp.com/releases/current/pr_090331_customers.html. The company states that it owns over 270 patents with an "acquisition value" of $97.6 million. *See* RPX Corporate Fact Sheet, http://www.rpxcorp.com/facts.html (last visited Sept. 5, 2009).

subject to the coordination cost constraints and political "noise" that sometimes prevent realization of socially preferred propertization outcomes. The constrained optimism of the STMP thesis, which envisions imperfect Coasean bargaining in the political and commercial marketplace subject to coordination cost constraints (rather than the unconstrained pessimism of the ATMP thesis, which assumes uniformly high coordination costs and therefore rules out Coasean outcomes, or the unconstrained optimism of the NTMP thesis, which assumes uniformly low coordination costs and therefore universally assumes Coasean outcomes) is apparently often (if only partially) satisfied in practice.

## III. REGIME SELECTION IN PRACTICE

Whether or not the process-based approach to propertization outcomes is a useful analytical construct will ultimately be determined in its sustained application to particular innovation markets, which will in turn yield a finer grained understanding of the ability (or inability) of adversely affected innovator populations to scale back excessive propertization outcomes. In this Part, I preliminarily apply this approach for the purpose of illustrating its potential explanatory power as a positive account of regime selection in innovation markets. First, I exploit the interaction between property trap effects and truncation actions to yield a general regime template that sketches a partially deterministic pattern consisting of an initial rush to propertization. This initial rush is then followed by self-correction actions, which are respectively aggravated and promoted principally as a function of coordination cost conditions and propertization biases among the dominant innovator population. Second, on the basis of this template, I describe a unique regime path for the semiconductor market, which has the useful characteristic that, in the course of several decades, it has traveled along virtually the full length of the extended regime path, which uniquely illustrates incumbents' capacity to recalibrate propertization outcomes in order to defend against imitation threats (which demand more property), *and* lower transaction cost burdens (which demand less property), *both* of which endanger long-term maximization of net gains from innovation investments.

### *A. Regime Template*

The standard narrative of intellectual property expansionism assumes a discrete one-way jump from a pristine "state of nature" commons to a state imposed property regime, which is then situated within a rigid framework where large resource holders consistently deploy disproportionate lobbying

and enforcement resources to promote increased propertization subject only to budget constraints, presumably at the expense of small innovators, individual end users, and the social interest more generally.[145] By this stage, it should be clear that this story is naïve insofar as it overlooks (among other things) the demonstrated possibility that even—or, most strikingly, *especially and only*—large resource holders will rationally decline to seek and will even resist expansions in intellectual property coverage if this generates anticipated transaction costs and associated innovation losses in excess of anticipated innovation gains. So long as we do not exclude the possibility that increasing transaction costs, and resulting innovation losses, may overwhelm innovation gains from increased propertization (which must hold true in *some* single instance for any formulation of the too much property thesis to have any practical relevance), a far more complex narrative emerges. Innovator populations continuously pursue the cumulative stream of net innovation returns by allocating resources to lobbying, adoption, and enforcement actions, as well as the formation and maintenance of cooperative arrangements, which in turn generate a variety of possible movements along a graduated regime path that is reversible, consists of multiple stages, and travels over a range of commons, property, and sharing regimes (including truncated and other hybrid property regimes).

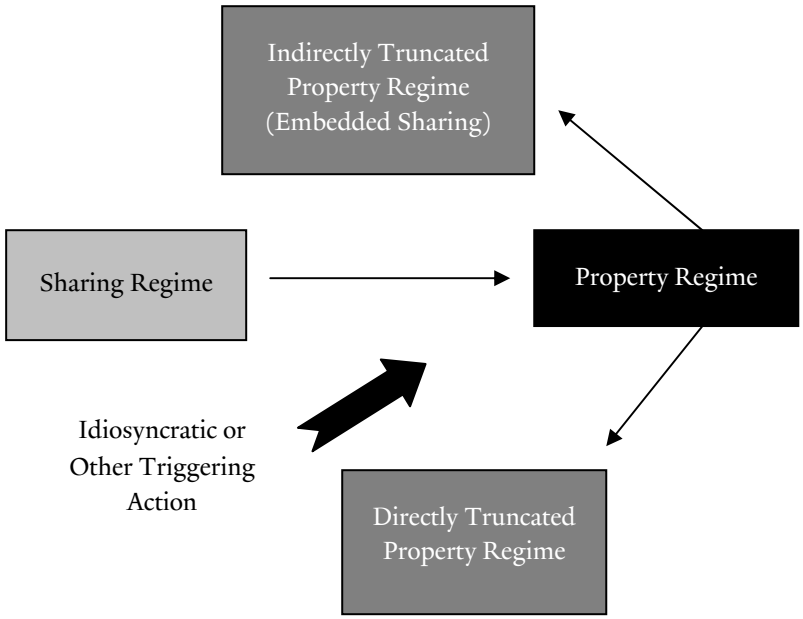
The Figure below provides a graphical illustration of these various regime types and some of the possible movements between, from, and to each type. Starting with a sharing regime that sustains innovation through extralegal appropriation mechanisms, the innovator population is driven by idiosyncratic actions or some other triggering event toward a state-provided property regime, which may then immediately or ultimately take several alternative forms. These include: (i) a fully deployed property regime; (ii) a directly truncated property regime where any legal protections are mostly a dead letter (as noted earlier, a not-uncommon occurrence[146]) and a sharing regime effectively persists as the dominant governance structure; or (iii) an indirectly truncated property regime, where the dominant property regime has some

145. Some intellectual property commentators take the view that strong intellectual property protections hurt both end users and small innovators. That is usually internally contradictory: the former are "net users" who rationally favor weak protections while the latter are usually "net producers" who rationally favor strong protections. Not coincidentally, the same mistaken identification of consumer and small producer interests led to persistent errors in antitrust commentary and jurisprudence over several decades. For extensive discussion of this point, see BORK, *supra* note 6.

146. *See supra* notes 31-35 and accompanying text.

meaningful force but is substantially displaced by embedded cooperative arrangements voluntarily formed by adversely affected innovator entities.

**Figure 8.**
GENERIC REGIME PATH[147]




These generic movements among regime types are consistent with the handful of existing discussions of evolutionary tendencies in intellectual property law, which envision alternating periods of underprotection and overprotection in response to external technological developments and exaggerated legal responses.[148] In contrast to these approaches, however, this

147. Consistent with prior Figures, increasingly dark coloration indicates increasing propertization, and vice versa.

148. *See* Ben Depoorter, *The Several Lives of Mickey Mouse: The Expanding Boundaries of Intellectual Property Law*, 9 VA. J.L. & TECH. 1, 34-41, 47-59 (2004) (arguing that legal evolution in intellectual property regimes follows a multi-stage path consisting of a technological jump, which then prompts overprotection as sought by producers who claim underprotection under the now outdated existing regime, which in turn prompts corrective lobbying by adversely affected users who use "outlier" applications of the new regime to argue for limits on purportedly excessive protections); Robert P. Merges, *One Hundred Years of Solicitude: Intellectual Property Law, 1900-2000*, 88 CAL. L. REV. 2187, 2190 (2000)

model links the historical ebbs and flows in intellectual property coverage with an underlying tradeoff between (i) innovation gains (which tend to demand more property); and (ii) transaction costs plus associated innovation losses (which tend to demand less), the practical implementation of which is in turn influenced by propertization biases and coordination cost conditions among dominant innovator populations. More specifically: this model anticipates that (i) any idiosyncratic lobbying or enforcement action will inherently tend to elicit excessive propertization whereby transaction costs (and resulting innovation losses) overrun innovation gains, which, barring sufficiently high coordination costs or a sufficiently skewed propertization bias, will then inherently be followed by (ii) truncation actions by adversely affected innovator populations that apply lobbying pressures or, of greater practical interest, form transactional structures to move toward a weaker propertization outcome. In the following case study, I will first assess the extent to which this idealized model of regime evolution tracks the actual evolution of intellectual property rights over approximately six decades in the U.S. semiconductor market.

### *B. Case Study: Regime Selection in the Semiconductor Industry*

The semiconductor market,[149] which dates its inception from the invention of the transistor in 1947 (or alternatively, the subsequent invention of the integrated circuit in 1961), is a field of obviously paramount importance (2007

(arguing that intellectual property evolution tends to follow a three-stage path consisting of disequilibrium induced by a technological development, case law adaptation, and legislative consolidation of an emerging consensus). For a variant of the "pendulum" view applied to industrial design protection, see J.H. Reichman, *Design Protection in Domestic and Foreign Copyright Law: From the Berne Revision of 1948 to the Copyright Act of 1976*, 1983 DUKE L.J. 1143, which argues that design protection follows a circular pattern where expanded copyright protection for industrial art elicits pressures in the general product market to contract copyright protection, which then elicits pressures to expand legal protections for industrial art.

**149.** As used herein (and following standard usage), "semiconductors market" refers to the market for integrated circuits (also known as a "chip" or "device"), which in turn generally fall into the three major categories of (i) memory components; (ii) logic devices; and (iii) integrated circuits (including microprocessors used in PCs) made of components that combine categories (i) and (ii). *See Semiconductors and Related Devices*, *in* 1 ENCYCLOPEDIA OF AMERICAN INDUSTRIES 1085, 1086 (Lynn M. Pearce ed., 4th ed. 2005). Broader definitions of the market would include semiconductor equipment and materials. For a detailed review of the market, see INTEGRATED CIRCUIT ENGINEERING CORPORATION, STATUS 1997: A REPORT ON THE INTEGRATED CIRCUIT INDUSTRY (Bill McClean ed., 1997).

worldwide revenues of $275.5 billion[150]) in modern economies based on the ubiquitous use of electronic components. Roughly following the generic template sketched above, this historical case study begins in a sharing regime that supports a collective innovation pool largely bereft of robust propertization, then experiences substantially increasing adoption and enforcement of intellectual property rights, and then backtracks to a hybrid regime where cooperative arrangements are embedded within a property regime. As I shall now examine in greater detail, the hybrid structure under which semiconductor firms currently operate is the result of an ongoing calibration process that can be understood in terms of three primary movements along a regime path moving between greater and lesser propertization, which is driven both by idiosyncratic actions that activate formally available property rights and self-correction efforts to minimize the transaction cost burdens associated with a robust property regime.

*1. Property at Bay (c. 1956-1982)*

The first stage coincides with the industry's early years of technological development, during which time the U.S. semiconductor industry effectively operated under a sharing regime where basic technologies were widely disseminated. Observers widely report that firms typically did not place great value on patent protection and devoted limited resources to obtaining and defending patents,[151] for the most part tolerating reverse engineering and relying on lead time and trade secrecy protections in order to secure returns.[152] This cooperative convention was rooted historically in two major actions. First, a collective innovation pool was generated through open licensing practices at IBM and AT&T,[153] which predated the 1956 antitrust consent decrees that made these mandatory, and are credited with instituting an industry convention of cross-licensing among domestic firms at below-market royalty

150. *See* Global Semiconductor Alliance, Industry Data, http://www.gsaglobal.org/resources/industrydata/facts.asp (last visited Sept. 5, 2009).

151. *See* JAFFE & LERNER, *supra* note 60, at 57. For similar observations, see DAVID P. ANGEL, RESTRUCTURING FOR INNOVATION: THE REMAKING OF THE U.S. SEMICONDUCTOR INDUSTRY 38-43 (1994); CHRISTOPHE LECUYER, MAKING SILICON VALLEY: INNOVATION AND THE GROWTH OF HIGH TECH, 1930-1970, at 253-94 (2006).

152. *See* Levin, *Semiconductor Industry*, *supra* note 116, at 82; Pamela Samuelson & Suzanne Scotchmer, *The Law and Economics of Reverse Engineering*, 111 YALE L.J. 1575, 1597 (2002).

153. *See supra* note 116 and accompanying text. It is commonly stated that the consent decrees were the "but for" reason for these "open licensing" practices. As Richard Levin shows in detail, this is arguably not the case given that these practices predated the decree and Bell Labs exceeded the decree's requirements thereafter. *See* Levin, *supra* note 116, at 76-78.

rates.[154] Second, to protect against supply disruptions, buyers customarily insisted that any supplier designate a "second source" supplier to cover any production shortfall, which in turn necessitated sharing process and product technology with a competitor.[155] Given the fundamental technological breakthroughs achieved during this period, it is hard to argue that this sharing regime did not provide a sustainable regime for innovation investment under then existing market conditions.

*2. Property Unleashed (c. 1982-1988)*

The second stage starts with a "demand shock" and "supply shock" to the sharing regime that had previously governed the semiconductor market: in respective order, this refers to the growth of the consumer electronics market and the market penetration achieved in the early 1980s by lower cost firms from Japan, which halved U.S. firms' share of the worldwide market in less than ten years.[156] U.S. firms' loss of market share to Japanese firms, who drew on but (following standard accounts) made little contribution to the existing innovation pool,[157] strained the appropriation capacities of the sharing regime that had theretofore governed the industry. These pressures ultimately resulted in abandonment of the sharing regime in two separate actions. First, in 1984,

**154.** *See* ANGEL, *supra* note 151, at 38-39; TEECE, *supra* note 108, at 199-201. On historically below-market royalty rates, see Andrew Pollack, *A Chip Maker's Profit on Patents*, N.Y. TIMES, Oct. 16, 1990, at D1.

**155.** *See* Andy Grove, *Churning Things Up,* FORTUNE, Aug. 11, 2003, at 115. This policy was complemented by the fact that the military funded R&D contracts with private firms, who were then required to disseminate publicly some technical findings. *See* Levin, *Semiconductor Industry*, *supra* note 116, at 66-82.

**156.** Japanese (and later, Korean and Taiwanese) firms pushed U.S. firms' share of the worldwide semiconductor market from approximately 56.7% in 1982 to 42.6% in 1992 and 48.3% in 2005. *See* SEMICONDUCTOR INDUS. ASS'N, STATS: WORLD MARKET SALES & SHARES—1982-2005 (2006), http://www.sia-online.org/galleries/press_release_files/shares.pdf.

**157.** At the time, U.S. manufacturers claimed that Japanese firms copied the circuitry layout of U.S.-developed chips, which was not subject to intellectual property protections. *See* Leon Radomsky, *Sixteen Years After the Passage of the U.S. Semiconductor Chip Protection Act: Is International Protection Working?*, 15 BERKELEY TECH. L.J. 1049, 1051-52 (2000). Some commentators attribute Japanese success principally to superior, lower-cost production methods, with little importance placed on imitation of existing technology. *See* ANGEL, *supra* note 151, at 191-92; ANDREW DICK, INDUSTRIAL POLICY & SEMICONDUCTORS: MISSING THE TARGET 54-55 (1995).

U.S. firms successfully lobbied for the Semiconductor Chip Protection Act[158] (SCPA), which provides sui generis protection for the "mask work" (that is, the circuitry layout design) of a semiconductor chip. The statute uniquely *authorizes* reverse engineering for purposes of creating a new mask work,[159] a feature that is consistent with an attempt to preserve low-cost sharing practices within a surrounding property regime.[160] The second action, however, is more suspect. In 1985, Texas Instruments (TI)[161] defected from the industry's low enforcement norm—at the time, to the loudly expressed chagrin of its competitors[162]—by bringing patent infringement suits against Japanese firms, and then subsequently demanding increased royalties from domestic licensees, often based on patents that TI had held since the early 1970s but, consistent with the then prevailing low enforcement convention, had not previously asserted.[163] Prominent firms such as IBM, Motorola, and AT&T—all of which had once been firm advocates for weak intellectual property rights in the semiconductors market—followed TI's defection, exploiting the newly activated property regime to push royalty rates on chips above historically

158. Semiconductor Chip Protection Act of 1984, tit. III, Pub. L. No. 98-620, 98 Stat. 3347 (codified at 17 U.S.C. §§ 901-914 (2006)).

159. 17 U.S.C. § 906(a). This exception permits reproduction of a protected mask work for purposes of "evaluating the concepts or techniques embodies in the mask work" and then incorporating the results of such analysis into a new mask work, which then in turn qualifies for protection assuming it meets the statutory originality requirement. *Id.*

160. For a description of reverse engineering practices at this time in the industry, see Levin, *Semiconductor Industry, supra* note 116, at 80-82. As a practical matter, the statute has become an underused "dead letter," largely due to certain technological advances that have frustrated third-party imitation that relies solely on reverse engineering the layout design. *See* Radomsky, *supra* note 157, at 1077-82. Others argue that it retains some residual function in facilitating licensing of "IP blocks" among "design only" firms in the industry. *See* Jeffrey T. Macher, David C. Mowery & David A. Hodges, *Reversal of Fortune? The Recovery of the U.S. Semiconductor Industry*, 41 CAL. MGMT. REV. 107, 127 (1998).

161. *See* Lawrence M. Fisher, *Patents: Aggressive Defender Branches Out*, N.Y. TIMES, Jan. 25, 1992, at L38.

162. *See* Pollack, *supra* note 154 (noting that, as result of litigation, Texas Instruments was considered the "schoolyard bully of the electronics industry"); *see also* Peter C. Grindley & David J. Teece, *Managing Intellectual Captial: Licensing and Cross-Licensing in Semiconductors and Electronics*, *in* ESSAYS IN TECHNOLOGY MANAGEMENT AND POLICY 204, 213 (David J. Teece ed., 2003) (noting "outrage" in industry to TI's aggressive litigation strategy, in deviation from industry norms).

163. *See* Bronwyn H. Hall, *Exploring the Patent Explosion*, *in* ESSAYS IN HONOR OF EDWIN MANSFIELD: THE ECONOMICS OF R&D, INNOVATION, AND TECHNOLOGICAL CHANGE, 195, 201-02 (Albert N. Link & F.M. Scherer eds., 2005); Pollack, *supra* note 154, at D19.

below-market levels,[164] which subsequently led the entire market into active deployment of patent protections. This result is consistent with the property trap model: absent coordination, perceived litigation risk and associated costs trigger rapid propertization—even by firms that had previously opposed it—following even a single defection from the existing cooperative norm.

*3. Property Constrained (c. 1988-present)*

The third stage is characterized by two contradictory developments. First, propertization has been accelerated throughout the market: the "TI strategy" became the industry norm as patenting rates increased dramatically among all semiconductor firms,[165] even exceeding the overall increase in U.S. patenting during the same period.[166] Small design-based firms in particular have made extensive efforts to adopt and enforce patent rights,[167] including both "fabless" firms that lack any independent fabrication capacity[168] and "chipless" firms that provide modular components (known as "IP blocks" or "cores") for

164. *See* Macher et al., *supra* note 160, at 128; Rosemarie Ham Ziedonis & Bronwyn H. Hall, *The Effects of Strengthening Patent Rights on Firms Engaged in Cumulative Innovation: Insights from the Semiconductor Industry*, *in* 13 ENTREPRENEURIAL INPUTS AND OUTCOMES: NEW STUDIES OF ENTREPRENEURSHIP IN THE UNITED STATES 133, 144-45 (Gary D. Libecap ed., 2001).

165. Adjusted relative to R&D dollars, this rate (that is, the *propensity* to patent) doubled between 1982 and 1992. *See* Ziedonis & Hall, *supra* note 164, at 144-45.

166. *See id.*

167. *See id.* at 137, 159 (finding that firms that entered the semiconductor industry after 1982 patent more intensively than pre-1982 entrants, where 1982 is used as a "marker" for strengthened patent rights based on creation of Federal Circuit; in particular, finding that small firms are *five times* more likely to patent than all other firms in the sample, which excludes, however, some of the largest diversified semiconductor manufacturers); Adam B. Jaffe, *The U.S. Patent System in Transition: Policy Innovation and the Innovation Process*, 29 RES. POL'Y 531, 540 (2000) (stating that semiconductor patents held by small "design" firms are disproportionately the subject of patent litigation); Rosemarie Ham Ziedonis, *Patent Litigation in the U.S. Semiconductor Industry*, *in* PATENTS IN THE KNOWLEDGE-BASED ECONOMY 181-82 (Wesley M. Cohen & Stephen A. Merrill eds., 2003) (finding that large vertically integrated semiconductor firms tend to cross-license patents while small design firms tend to adopt more litigious strategies).

168. *See* Ziedonis & Hall, *supra* note 164, at 142-43. "Fabless" firms now constitute roughly twenty percent of the worldwide semiconductor chip market. *See* Global Semiconductor Alliance, http://www.gsaglobal.org (last visited Sept. 5, 2009). For further discussion of the fabless sector and its reliance on patent rights, see Rajà Attia, Isabelle Davy & Roland Rizoulières, *Innovative Labor and Intellectual Property Market in the Semiconductor Industry, in* TECHNOLOGY AND MARKETS FOR KNOWLEDGE: KNOWLEDGE CREATION, DIFFUSION, AND EXCHANGE WITHIN A GROWING ECONOMY 137 (Bernard Guilhon ed., 2001).

assembly into complex integrated circuit products.[169] Second, formal propertization has been simultaneously limited by efforts undertaken by large firm incumbents, consisting of: (i) constrained enforcement of patent rights against other large firm competitors (who have not *initiated* more patent litigation since the early 1980s, controlling for increases in the number of patents held and/or amount of R&D spending);[170] and (ii) multiple industry-level and firm-level cooperative ventures, covering a wide variety of research consortia, strategic alliances,[171] and broad "field of use" cross-licensing agreements among holders of similarly valued patent portfolios, which often set royalty payments at low or nominal levels consistent with the underlying objective of ensuring reciprocal access.[172] At the industry level there exist several large-scale ventures of substantial magnitude, including: (i) the Semiconductor Industry Association (the "SIA"), founded in 1977 by leading firms as the industry's trade association;[173] (ii) through SIA and cognate associations in other countries, the International Semiconductor Technology Roadmap for Semiconductors, a trade group that sets technological milestones that guide R&D investment by member firms;[174] and (iii) several international standard-setting consortia that are vital to the development of the market in

**169.** *See* Attia et al., *supra* note 168, at 165-67.

**170.** *See* Bronwyn H. Hall & Rosemarie Ham Ziedonis, An Empirical Analysis of Patent Litigation in the Semiconductor Industry 14-16 (Jan. 2007) (unpublished manuscript, on file with author); *see also* Allison et al., *supra* note 115, at 446, 472 (noting that patents in the seminconductor industry are less likely to be litigated than those in other industries); Allison et al., *supra* note 138, at 25-27 (finding that semiconductor patents are a minor percentage of two datasets, which consisted of one dataset consisting of every patent that has been litigated eight times or more during 2000-2007 and one randomly selected control set of patents that had been litigated once during that same period).

**171.** *See* ANGEL, *supra* note 151, at 3, 85-86; Macher et al., *supra* note 160, at 120.

**172.** *See* TEECE, *supra* note 108, at app. A; John H. Barton, *Antitrust Treatment of Oligopolies with Mutually Blocking Patent Portfolios*, 69 ANTITRUST L. J. 851 (2001); Grindley & Teece, *supra* note 162; *see also* 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, 125 (2001) (finding that large firms appear to expand patent portfolios largely for the defensive purpose of preventing holdup or infringement claims by rivals holding potentially overlapping patents); Moore, *supra* note 27, at 1544-45 (finding that semiconductor patents show high renewal rates based on all patents issued in 1991, but noting that based on other results, semiconductor patents are infrequently litigated relative to other industries, and concluding that these findings together suggest that semiconductor patents are primarily used as trading currency for cross-licensing purposes).

**173.** *See* Semiconductor Industry Association, Industry Fact Sheet, http://www.sia-online.org/cs/industry_resources/industry_fact_sheet (last visited Sept. 5, 2009).

**174.** *See* International Technology Roadmap for Semiconductors, http://www.itrs.net (last visited Sept. 5, 2009).

"IP modules" that are sold as intermediate inputs to fabless firms and integrated manufacturers.[175] Technology sharing is most expressly implemented in SEMATECH,[176] a unique institution in U.S. industrial policy that was founded in 1988 by thirteen firms (with assistance from the federal government) then representing eighty percent of the U.S. semiconductor chip market and now includes domestic and foreign members representing fifty percent of the worldwide semiconductor chip market.[177] This cooperative arrangement has facilitated the improvement of semiconductor-manufacturing technology and coordination of industry technological standards through internal R&D programs and funding of external R&D programs at private firms, the results of which are then disseminated to SEMATECH members in rough conformity with a knowledge sharing model.[178]

175. For further information, see ASHISH ARORA, ANDREA FOSFURI & ALFONSO GAMBARDELLA, MARKETS FOR TECHNOLOGY: THE ECONOMICS OF INNOVATION AND CORPORATE STRATEGY 257-58 (2001); and Attia et al., *supra* note 168, at 164-65.

176. For discussions of this organization, see LARRY D. BROWNING & JUDY C. SHETLER, SEMATECH: SAVING THE U.S. SEMICONDUCTOR INDUSTRY (2000); Larry D. Browning, Janice M. Beyer & Judy C. Shetier, *Building Cooperation in a Competitive Industry: SEMATECH and the Semiconductor Industry*, 38 ACAD. MGMT. J. 113 (1995); and Rose Marie Ham, Greg Linden & Melissa M. Appleyard, *The Evolving Role of Semiconductor Consortia in the United States and Japan*, 41 CAL. MGMT. REV. 137 (1998).

177. *See* SEMATECH INC., 2007—A YEAR IN REVIEW 3 (2008), http://www.sematech.org/corporate/annual/annual07.pdf. Contributions from 1987-1996 consisted of $850 million in dues from members and a matching amount in federal funding. *See* Ham et al., *supra* note 176, at 149. Federal funding ceased in 1996. *Id.* Note that smaller firms generally do not participate in SEMATECH due to its capped fixed-fee schedule (one percent of annual revenues, subject to a minimum of one million dollars and a maximum of fifteen million dollars), which yields amounts that may be manageable in absolute terms for an industry leader but exorbitant for a small entrant. *See* Douglas A. Irwin & Peter J. Klenow, *Sematech: Purpose and Performance*, 93 NAT'L. ACAD. SCI. USA 12,739, 12,740 (1996).

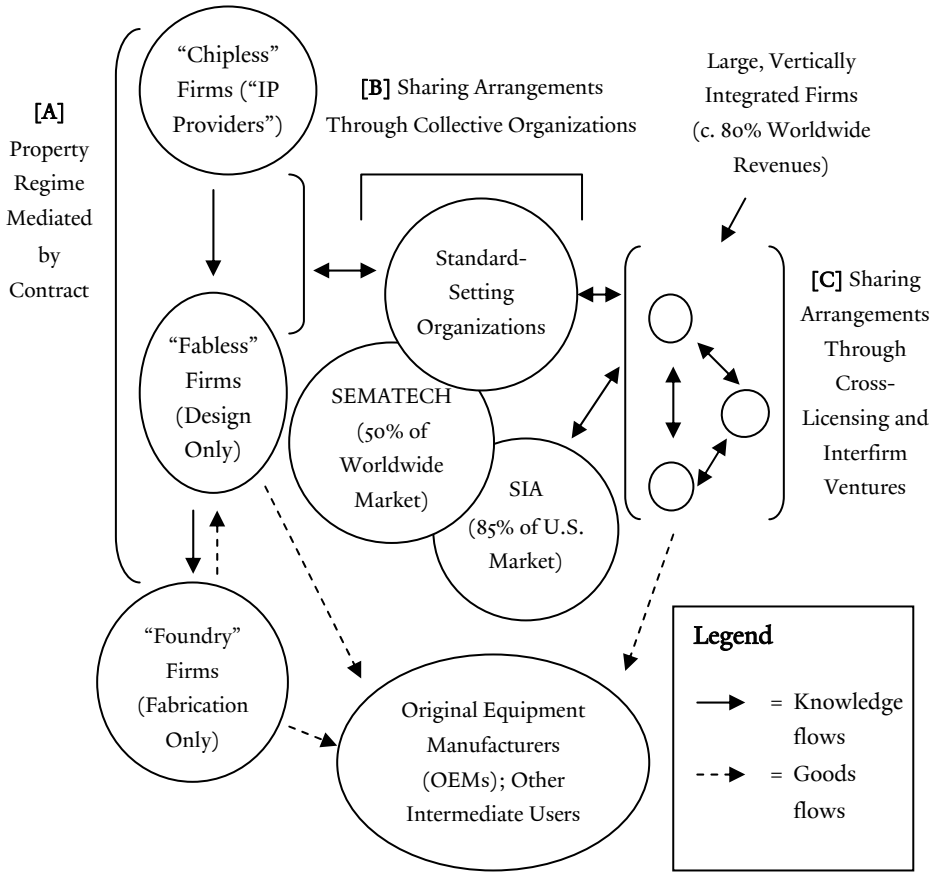
178. *See* BROWNING & SHETLER, *supra* note 176, at 107-08; Ham et al., *supra* note 176, at 143-44. A General Accounting Office report notes that consortium members state that SEMATECH has successfully shifted the industry from a "competitive, arms-length relationship between semiconductor manufacturers and their suppliers toward a culture that establishes long-term relationships between semiconductor manufacturers and their suppliers." U.S. GEN. ACCOUNTING OFFICE, FEDERAL RESEARCH: SEMATECH'S TECHNOLOGICAL PROGRESS AND PROPOSED R&D PROGRAM 8 (1992), http://archive.gao.gov/d33t10/147343.pdf. Other observers are less sanguine concerning the performance of SEMATECH, arguing that it failed to achieve its objectives of improving industry profitability, generated few new innovations, and abandoned its cooperative research mission for "bail-out" investments in distressed equipment manufacturers. *See* DICK, *supra* note 157, at 65-70.

*4. End Result: Regime Bifurcation*

The semiconductor industry illustrates a hybrid innovation regime generated by a multidecade process of moving up and down the regime path between lesser and greater levels of propertization, each of which achieves some tradeoff between innovation gains and transaction cost losses. Figure 9 below provides a graphical overview of this mixed regime landscape, where (i) an actively deployed innovation regime, employed to the fullest extent by small-firm entrants and to a partial extent by large-firm incumbents, is infiltrated at multiple points by (ii) firm-level and industry-level cooperative mechanisms, used primarily by large-firm vertically integrated incumbents with similarly sized innovation portfolios. The analytical payoff from a bottom-up approach to understanding propertization processes in innovation markets should be apparent: the substantial complexity—or "regime diversity"—relative to the standard commons/property dichotomy is striking. On the one hand, widespread adoption and aggressive use of the formal property rights regime (mostly, but not always, by smaller firms) is indicative of a property regime, which is sometimes afflicted by arduous patent litigations. Exhibit A for this unwelcome side effect is the Dickensian litigation currently being pursued by Rambus, a semiconductor firm that is pursuing suits against several firms for infringement of patents that purportedly cover technologies adopted by an industry standard-setting consortium.[179] On the other hand, the transaction cost burdens attendant to a formal property regime are ameliorated by constrained patent enforcement among large-firm enterprises, cross-licensing arrangements, and an impressive variety of industry-level cooperative institutions, as a result of which mostly larger firms share valuable knowledge with similarly situated competitors.

179. There is no single history of the complex and multiple litigations pursued by Rambus against most of the leading integrated chip manufacturers (and the various countersuits filed in response). For a summary overview, see Rambus–Wikipedia, http://en.wikipedia.org/wiki/Rambus (last visited Sept. 5, 2009). For all motions, filings, and orders in the various proceedings, see Rambus Litigation Update, http://investor.rambus.com/litigation.cfm?CategoryID=779 (last visited Sept. 5, 2009).

**Figure 9.**
REGIME DIVERSITY IN THE SEMICONDUCTOR INDUSTRY[180]




180. Note that, for presentation purposes, this Figure does not illustrate (i) "involuntary" knowledge spillovers to small-firm nonmembers from some cooperative ventures funded by large-firm members, and (ii) the use by some vertically integrated manufacturers of "foundries" for manufacturing capacity and "chipless" firms as sources of design components. For more detailed discussion of the latter phenomenon, see Attia et al., *supra* note 168, at 165-66.

Through this bifurcated structure (which can be described as a potential overpropertization outcome adjusted by corrective truncation actions), the low transaction cost environment that initially characterized the industry partially persists to the present day among incumbent firms despite stark changes in the total resources the industry allocates to the adoption and enforcement of formal intellectual property rights. Hence, despite operating under the burden of tens of thousands of patents and periodic patent litigations, it can fairly be argued that the industry has substantially (but certainly not entirely) escaped the property trap that could stifle product development beneath transaction cost burdens. Following the too much property thesis and its related variants, this is an inherently surprising achievement given that multiple overlapping property rights and extraordinarily high capital investments would appear to make the semiconductor market an especially strong candidate for falling prey to a patent thicket that stifles innovative output. Following a process-based approach, however, this surprising result is largely predictable: the rational incentives of large resource holders in maximizing the cumulative stream of net innovation returns, together with inherently low obstacles to mutually beneficial coordination in concentrated markets, generate cooperative structures that relieve transaction cost burdens that might otherwise endanger innovative output.

## CONCLUSION

This Article offers a process-based approach to understanding propertization processes in innovation markets: namely, the expansion and contraction of intellectual property rights is viewed predominately as a function of private market investments in lobbying, adoption, and enforcement actions as well as a wide range of transactional and organizational arrangements for distributing and exchanging intellectual assets. Application of this bottom-up framework confirms the standard view that *individually* rational pursuit of economic rents can yield *collectively* irrational levels of intellectual property coverage: rational expectations of infringement liability and resource bottlenecks drive mutually destructive overconsumption of intellectual property rights. But a process-based approach makes the critical observation that this overpropertization outcome is contingent upon the satisfaction of certain predicate conditions, which implies that it will sometimes be subject to modification or reversal. Where adversely affected firms face low coordination costs (which is *most* likely to characterize concentrated or well-organized economic interests) and are neither clearly net users nor net producers of intellectual resources (which is *most* likely to characterize large firms in cumulative-innovation industries), then

overpropertization is likely to be alleviated by lobbying actions or, more typically, a wide range of voluntarily formed sharing arrangements or even forfeitures of intellectual assets. Conversely, where these conditions are *not* substantially satisfied, then the pathological result is likely to be realized. This cautiously optimistic view of propertization processes relies on a reasoned application of private interest in service of the public interest: subject to coordination costs and propertization biases, transaction cost inefficiencies generated by overpropertization induce political, transactional, and organizational entrepreneurship to accrue the gains from correcting it. To be sure, this proposition is far from a comprehensive account of regime selection in innovation markets: it is well known that political markets are "noisy" and further inquiry will demand elucidation of the complex interaction between demand-side and supply side dynamics in the aggregate determination of propertization outcomes. It can nonetheless be observed that there exists some meaningful range of circumstances where the *most* influential market participants are likely to have socially compatible incentives and capacities to correct the transaction cost burdens and associated losses that arise from overpropertization outcomes. And if *that* is the case, then widespread but inherently uncertain claims that innovation markets chronically suffer from too much property are presumptively vulnerable for a simple reason: sometimes, the market will not stand for it.