COORDINATION-FOCUSED PATENT POLICY

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ABSTRACT: This paper explores the practical consequences of an important shift that has gradually taken place in patent theory. Although it was long agreed that the purpose of granting patents is to reward invention, some scholars now attempt to justify the patent system based on its role in facilitating information exchange and enabling technical coordination among firms. This change in justification is controversial, and its viability remains a fiercely contested question. But despite this intense attention at the level of theory, little has been said about the consequences of this debate for patent policy itself. This Article seeks to fill that void, developing a set of mid-level principles from coordination theory and showing how those principles would likely result in different outcomes for a wide range of policy questions. This analysis suggests that the current debate about the justifications for patenting has significant unappreciated consequences for patent law in practice—and that the terms of that debate have perhaps been based on unfounded assumptions about how a coordination-focused patent system would actually operate.

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INTRODUCTION

For its first two centuries, the U.S. patent system had a mission that was clear and well-understood. Courts and commentators long agreed that the purpose of offering patent protection is to increase incentives to invent, offering exclusive rights as a kind of quid-pro-quo reward for a successful invention.[1] According to this view, the patent system addresses a problem of a public good, using public grants to subsidize an activity that would otherwise occur below the socially optimal level. In this way, the patent system is designed to effect a kind of decentralized tax-and-spend policy, with consumers bearing higher prices so that inventors may enjoy supracompetive profits in exchange for inventive contributions they would not otherwise have the same incentives to make.

In recent years, this consensus has broken. Scholars have since observed a variety of other purposes that may be served by the patent system beyond simply rewarding inventive accomplishment. For example, commentators have suggested that patents may play an important role in reducing transaction costs around information, allowing for more open communication, mitigating the need for trade secret protection, and facilitating easier transfer of technology from one group to another.[2] Expanding this theory slightly, they have also noted that patents can be used to encourage public disclosure, reduce the costs of identifying potential collaborators, and enable smoother intra- and inter-firm cooperation.[3] Picking up on this theme of collaboration, another group has investigated the role that patents

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[1] *See* Ward S. Bowman Jr., Patent and Antitrust Law: A Legal and Economic Appraisal 2-3 (1973); *see also* F.M. Scherer & David Ross, INDUSTRIAL MARKET STRUCTURE AND ECONOMIC PERFORMANCE 621-24 (3d ed. 1990) (giving standard rewards-based explanation as the logic of patent protection); Louis Kaplow, *The Patent-Antitrust Intersection: A Reappraisal*, 97 HARV. L. REV. 1813, 1817, 1821-22 (1984).

[2] *See* Edmund W. Kitch, *The Nature and Function of The Patent System*, 20 J.L. & ECON. 265, 277-79 (1977) [hereinafter Kitch, *Nature and Function*]; William M. Landes & Richard A. Posner, The Economic Structure of Intellectual Property Law 328 (2003); Paul J. Heald, *A Transaction Costs Theory of Patent Law*, 66 OHIO ST. L. J. 473, 488-89, 497 (2005) [hereinafter Heald, *Transaction Costs*]; Paul J. Heald, *Transaction Costs and Patent Reform*, 23 SANTA CLARA COMPUTER & HIGH TECH. LJ 447, 457 (2006); Julien Pénin, *Patents Versus Ex Post Rewards: A New Look*, 34 RESEARCH POLICY 641, 649 (2005) [hereinafter Pénin, *Patents Versus Ex Post Rewards*] (discussing role of patents in technology transfer).

[3] *See* Landes & Posner, *supra* note 2, at 329; Robert Mazzoleni and Richard R. Nelson, *Economic Theories About the Benefits and Costs of Patents*, 32 J. ECON. ISSUES 1031, 1039 (1998); Robert P. Merges, *A Transactional View of Property Rights*, 20 BERKELEY TECH. L.J. 1477, 1487-90 (2005) [hereinafter Merges, *Transactional View*]; Robert P. Merges and Ashish Arora, *Specialized Supply Firms, Property Rights and Firm Boundaries*, 13 INDUSTRIAL & CORPORATE CHANGE 451 (2004); Heald, *Transaction Costs*, *supra* note 2, at 475 & nn 15-16; Jessica Silbey, *Patent Variation: Discerning Diversity Among Patent Functions*, 45 LOY. U. CHI. L.J. 441, 467 (2013); Julien Pénin, *Patent Policy: A Need to Focus on Both Appropriation and Coordination Failure*, 16 EURO. J. OF ECONOMIC & SOCIAL SYSTEMS 109, 111 (2003) [hereinafter Pénin, *Patent Policy*].

may play in the formation, operation, and dissolution of joint ventures.[4] This emerging work suggests that a view of patents as merely rewards for invention may oversimplify their function in facilitating the development of new technology—that patents may also serve an important role in coordinating industry activity around technology before and after patenting has occurred.

This movement is controversial. Other commentators have questioned these coordination-related justifications for patent rights, suggesting that the patent system is ill-equipped to play these roles, is outmatched by superior approaches to these problems, or is otherwise best left to its traditional rewards-focused responsibilities.[5] But a purely rewards-based view of the patent system has its challenges as well. For one, it is hard to explain why so many inventors participate in the patent system if rewards are their only objective, for only a vanishingly small number of patents ever return any kind of profit to their owners.[6] Moreover, many have argued that it is difficult to justify the current patent regime on the grounds of rewards alone.[7] Perhaps for this reason, an increasing number of commentators have explicitly adopted coordination-related reasoning when seeking to explain or justify the patent system.[8]

Despite the extensive discussion about the legitimacy of these coordination roles for the patent system, very little has been said about the consequences of this

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[4] *See* William E. Kovacic, *Intellectual Property Policy and Competition Policy*, 66 NYU ANN. SURV. AM. L. 421, 424 (2011); Antoine Bureth et al., *Patenting Practices Within the Upper-Rhine BiovalleyNetwork: Exclusion and Coordination Rationales*, 8-9 (2005) (unpublished manuscript), *available at* http://www.liuc.it/ricerca/istitutoeconomia/laweconomicsjuly2005/papers/Bureth_et_al_LIUCpaper.pdf.

[5] *See*, *e.g.*, Michael J. Burstein, *Exchanging Information Without Intellectual Property*, 91 TEX. L. REV. 227, 246-47, 262 (2012); Mark A. Lemley, *The Myth of the Sole Inventor*, 110 MICH. L. REV. 709, 748 (2012) [hereinafter Lemley, *Myth*].

[6] *See* Clarisa Long, *Patent Signals*, 69 U. CHI. L. REV. 625, 626-27 (2002); Pénin, *Patents Versus Ex Post Rewards*, *supra* note 2, at 642, 646-48; John R. Allison et al., *Valuable Patents*, 92 GEO. L.J. 435, 440-41 (2004); Mark A. Lemley, *Rational Ignorance at the Patent Office*, 95 NW. U. L. REV. 1495, 1500-08 (2000) [hereinafter Lemley, *Rational Ignorance*]. For a summary of other attempts to answer this question, *see infra* note 40 and accompanying text.

[7] *See* Landes & Posner, *supra* note 2, at 326-27; Heald, *Transaction Costs*, *supra* note 2, at 474-75, 499-501; Robert W. Hahn, *The Economics of Patent Protection: Policy Implications from the Literature* 4, 17-22 (2003), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=467489; Pénin, *Patent Policy*, *supra* note 3, at 117-19 (summarizing objections to the traditional rewards account); Bureth, *supra* note 4, at 5-6 (summarizing prior empirical work); F. Scott Kieff, *Coordination, Property, and Intellectual Property*, 56 EMORY L.J. 327, 401-404 (2006) [hereinafter Kieff, *Coordination*].

[8] *See*, *e.g.*, Landes & Posner, *supra* note 2, at 328; Pénin, *Patent Policy*, *supra* note 3, at 110-11, 124-25; Mazzoleni & Nelson, *supra* note 3, at 1037-38; Kitch, *Nature and Function*, *supra* note 2, at 276; Heald, *Transaction Costs*, *supra* note 2*;* Merges, *Transactional View, supra* note 3, 1487-90.

debate for patent policy itself. The incongruity is often striking. For example, in their canonical text, *The Economic Structure of Intellectual Property Law*, William Landes and Richard Posner conclude that the strongest reasons for having a patent system have nothing to do with the traditional story about rewarding invention, instead citing alternative theories that fall soundly within the coordination function.[9] But just a few pages later they conclude that these justifications—while "compelling in the aggregate"—tell them nothing about what patent policy should actually look like.[10] And this admission is indicative of a much larger problem. Although a growing group of scholars have begun to embrace an entirely different justification for the patent system than the one that has persisted for over two hundred years, no one has thoroughly examined the consequences of this shift in purported mission.[11] Instead, commentators have tended to assume that coordination-focused patent policy looks pretty much exactly like rewards-focused patent policy.[12] As a result, patent policy continues to be made on the basis of what some consider to be a largely outdated theory, and the debate about the desirability of its purported replacement continues to depend on a set of largely untested assumptions.[13]

A reasonable skeptic might ask whether any of this actually matters. After all, if *either* the rewards theory or the coordination theory leads to a system of "strong" patent rights, what really is the difference? But, as this Article will show, one's answer to the question of "why have a patent system?" has substantial and far-reaching consequences for a wide array of second-order questions. Upon reflection, this shouldn't come as a surprise: the rewards and coordination functions solve different problems. They have quite different theories of operation, which in turn lead to divergent intermediate goals for how the patent system should work. For example, the rewards-versus-coordination debate turns out to have significant consequences for the ideal stability of patent grants, the reliability of the right to exclude, and the optimal scope of patent protection. These mid-level values in turn implicate a wide range of patent rules, such as the presumption of validity, the enforceability of no-challenge clauses, mechanisms for post-grant review, the legality of various forms of licensing practices, and the competitive effects of mergers of competing patent portfolios, just to name a few.

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[9] *See* Landes & Posner, *supra* note 2, at 326-30. An extensive discussion of what this Article means by "coordination function" is included in Part II.

[10] *See* Landes & Posner, *supra* note 2, at 330-31.

[11] *Cf*. Pénin, *Patent Policy*, *supra* note 3, at 123, 125-26. Indeed, the most extensive investigation of the policy implications of these theories seems to be found in Kitch's initial exposition of them back in 1977. *See* Kitch, *Nature and Function*, *supra* note 2, at 280-89.

[12] When they acknowledge any potential differences between the two, prior commentators have typically assumed that the coordination function depends on earlier, broader patent grants. *See* Burstein, *supra* note 5, at 245-46, 278 (making this observation). This view can be traced to the early days of coordination theory, *see* Kitch, *Nature and Function*, *supra* note 2, at 280-89, but is long overdue for reevaluation. *See infra* IV.A & .B.

[13] *See* Landes & Posner, *supra* note 2, at 330-31; Pénin, *Patent Policy*, *supra* note 3, at 125 (both observing need for more development in this area).

This exercise is valuable whether or not one believes that the coordination function can justify patenting, at least because it demonstrates there's much more at stake in this debate than whether or not we continue to have a patent system. As this Article will show, a case for "strong" patent rights invoking the coordination function leads to a very different-looking patent system than an equivalent case for patent rights invoking the rewards function. (Similarly, new research undermining the coordination justification would suggest a different policy response than a movement casting equivalent doubt on the rewards justification.) Moreover, even if the coordination function is rejected as a primary goal of the patent system—even if rewarding invention is universally accepted as the reason for granting patents—there may still be some residual coordination benefits available depending on how those patent-based rewards are implemented. A deeper understanding of how the coordination function operates may allow policymakers to better include coordination benefits as a secondary consideration, an additional factor useful for breaking ties in situations where the rewards view is indifferent or ambivalent.

A clear view of the relationship between each function and the particular rules it implies is also critical for adapting the patent system to shifts in larger innovation policy over time. Both the rewards function and the coordination function have substitutes outside the patent system—grants, prizes, and tax credits in the case of the rewards function,[14] more vigorous enforcement of contractual restraints and trade secrets in the case of the coordination function.[15] As a policymaker chooses to incentivize invention through more generous research tax credits, for example, that move has consequences for the role left for the patent system, and may call for a shift from rewards-focused to coordination-focused patent policies. And, of course, these interrelationships work in both directions. Greater awareness of the patent rules that will be necessary to facilitate rewards or coordination may assist a policymaker in deciding the extent to which she wants to use the patent system for these functions at all, as opposed to relying on alternate mechanisms for achieving the same goals. In this way, this project contributes to the greater debate about the desirability of using the patent system for coordination in the first place.

Ultimately, of course, rewards and coordination objectives do not have to be mutually exclusive goals. Studying them in isolation can produce a deeper understanding of how each function operates, but a patent policymaker might well seek to use the same system of exclusive rights to pursue both categories of benefits simultaneously. Indeed, there may be substantial synergies available by rewarding invention using a system that also happens to facilitate coordination—or

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[14] *See* Daniel J. Hemel & Lisa Larrimore Ouellette, *Beyond the Patents-Prizes Debate*, 92 TEX. L. REV. 303, 307, 311-12 (2013); Joseph E. Stiglitz, *Economic Foundations of Intellectual Property Rights*, 57 DUKE L.J. 1693, 1719-24 (2008).

[15] *See* Heald, *Transaction Costs*, *supra* note 2, at 476; Mark A. Lemley, *The Surprising Virtues of Treating Trade Secrets as IP Rights*, 61 STAN. L. REV. 311, 336-37 (2008) [hereinafter Lemley, *Surprising Virtues*].

vice versa. For this reason, this Article does not only contrast the policy trade-offs implicated by the rewards and coordination theories, but also pays particular attention to ways that the existing rewards-focus system could be adapted to encompass a greater role for coordination, if such an expanded role is found to be desirable.

Because the consequences of including coordination goals in patent policy are varied and far-reaching, applying this analysis to every domain of patent policy is likely to become an expansive undertaking. As a first movement towards addressing this extensive void, this Article seeks to elucidate the theoretical foundation for both the coordination and rewards functions, understand how these theories lead to diverging intermediate policy goals, and give several examples of how specific patent rules would change as a result. In this way, this Article lays the groundwork for future projects evaluating the consequences of rewards-versus-coordination in further detail within the host of specific policy domains that merit revisiting.

This Article proceeds in six parts. Part I introduces the rewards function of the patent system and the traditional approaches to patent policy that have followed therefrom. Part II introduces the coordination function and explains how it relates to other potential functions of the patent system. Part III develops a theory of the coordination function and identifies several features of that patent system that will have a significant influence on the coordination function's effectiveness. Part IV applies the results of Part III to a variety of issues in patent law and explains how these questions would need to be evaluated differently for a patent system increasingly focused on coordination in lieu of rewards. Part V presents a few caveats and identifies several areas for future work. Part VI concludes.

I. THE TRADITIONAL JUSTIFICATION: REWARDING INVENTION

A. Theoretical Foundations

Under the traditional, rewards-focused approach to patent policy, the purpose of the patent system is to incentivize invention through the promise of a regulatory bequest of market power.[16] In exchange for producing some socially useful invention, the inventor is given a time-limited exclusive right to her creation. In principle, that exclusive right vests its holder (at least sometimes) with some market power, which in turn causes some transfer of wealth back to the inventor. At the same time, the exercise of this market power results in some

[16] *See* Hahn, *supra* note 7, at 7-8 (summarizing this argument). Mazzoleni and Nelson refer to this theory as the "innovation motivation" theory. *See* Mazzoleni & Nelson, *supra* note 3, at 1033, 1035.

deadweight loss, which is to be accepted—or not—as the cost of rewarding creative activity through a system of private exclusive rights.[17]

In this view, by offering an incentive to invent, the patent system addresses a classic problem of a public good. Without some form of regulatory intervention, the inventor would bear the full costs of creating the invention but would not be able to appropriate the full benefits, therefore leading to the under-production of inventions generally.[18] The goal of the rewards function is to correct this potential market failure by enabling inventors to appropriate more of the benefits of their new technologies.[19]

As others have noted, there are a variety of policy alternatives that could serve provide similar incentives to invent: government grants, tax deductions, publicly and privately administered prizes, indirect subsidies for research, to name a few.[20] The traditionally recognized advantage of the patent system over these competitors is its administrative simplicity, since the value of exclusive patent rights is naturally dependent on the value of the underlying technology.[21] Rather than trying to place a dollar value on any given contribution, the patent office simply grants exclusive rights commensurate with the inventor's achievement and allows the market to sort out what those rights are actually worth.[22]

In evaluating the effectiveness of the patent system in rewarding invention, commentators have traditionally focused on one category of benefit and two categories of costs. The promised dynamic benefit is the increased investment in research and development resulting from the promise of wealth transfer under patent-created market power.[23] Within some range, the more wealth transfer to inventors the better—the greater investment in research, the more urgent the search

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[17] *See* Kenneth J. Arrow, *Economic Welfare and the Allocation of Resources for Invention*, in THE RATE AND DIRECTION OF INVENTIVE ACTIVITY 609, 619 (1962); Pénin, *Patent Policy*, *supra* note 3, at 113.

[18] *See* Landes & Posner, *supra* note 2, at 294; Kitch, *Nature and Function, supra* note 2, at 266; Pénin, *Patents Versus Ex Post Rewards, supra* note 2, at 643; Pénin, *Patent Policy*, *supra* note 3, at 111-12; Hahn, *supra* note 7, at 7-8.

[19] *See* Bowman, *supra* note 1, at 2-3; Pénin, *Patents Versus Ex Post Rewards*, *supra* note 2, at 643; Hahn, *supra* note 7, at 7-8.

[20] *See* Hemel & Ouellette, *supra* note 14, at 311-12; Pénin, *Patent Policy*, *supra* note 3, at 111-12.

[21] *See* Adam Smith, Lectures on Jurisprudence 82-83 (R.L. Meek, *et al*., eds. 1978); Pénin, *Patent Policy*, *supra* note 3, at 112-13. More recently, scholars have questioned whether the benefits of this administrative simplicity outweigh the costs of rewarding invention by way of a patent system. *See*, *e.g.*, Michael Abramowicz, *Perfecting Patent Prizes*, 56 VAND. L. REV. 115, 122-23 (2013) [hereinafter Abramowicz, *Patent Prizes*]; Steven Shavell & Tanguy van Ypersele, *Rewards Versus Intellectual Property Rights*, 44 J.L. & Econ. 525, 539 (2001).

[22] *See* Suzanne Scotchmer, INNOVATION AND INCENTIVES 38-40 (2004) (discussing comparative benefits of patents and prizes).

[23] *See* Pénin, *Patents Versus Ex Post Rewards*, *supra* note 2, at 643.

for new problems to solve, and so on.[24] But that wealth transfer of course comes at a price. The first part of this price is the administrative cost of operating a patent system—the time and expense of filing patent applications, examining them, litigating patent disputes, and so on.[25] The second part of this price is the deadweight loss associated with reduced consumption of the patented good as a result of the inventor's market power.[26] When selecting how much reward to provide to inventors through the patent system, policymakers must consider not only the benefits associated with some degree of wealth transfer to inventors, but also the administrative costs and deadweight losses that must be incurred to produce that wealth transfer.[27]

Alternatives to the patent system for rewarding invention have analogous costs and benefits as well. For example, a system of governmentally administered prizes could instead be used to transfer wealth to inventors, but it would also impose administrative costs in the form of time and expense preparing prize applications, soliciting the opinions of experts, reviewing applications, and distributing rewards.[28] These grants would similarly cause deadweight losses as a result of the taxes necessary to fund the grants.[29] Whether the patent system or a prize system can achieve the desired level of wealth transfer at lower cost is a subject of much debate, and may very well depend on the time and circumstances of inventive activity.

Importantly, as far as the objective of rewarding invention is concerned, the choice between a patent system and a prize system is merely one of cost-effectiveness.[30] If prizes or another form of direct public funding were demonstrated to reward invention with lower administrative costs and deadweight losses, the patent system could be safely replaced by the competing regime.[31] And,

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[24] Of course, it is also possible for these dynamic benefits to be offset by dynamic harms if invention is rewarded *too* much. *See* Mark A. Lemley, *Property, Intellectual Property, and Free Riding*, 83 TEX. L. REV. 1031, 1060-61, 64 (2005) [hereinafter Lemley, *Free Riding*].
[25] *See* Lemley, *Free Riding*, *supra* note 24, at 1064 (estimating the administrative costs of the patent system).
[26] *See* Pénin, *Patents Versus Ex Poste Rewards*, *supra* note 2, at 643-44.
[27] *See* Scotchmer, *supra* note 22, at 98-103. In addition, a system of exclusive rights may impose a variety of dynamic costs. *See infra* note 38 and accompanying text.
[28] *See* Pénin, *Patents Versus Ex Poste Rewards*, *supra* note 2, at 644-45; Hemel & Oullette, supra note 14, at 361-62; Abramowicz, *Patent Prizes*, *supra* note 21, at 206-11.
[29] Hemel & Oullette, *supra* note 14, at 314; Abramowicz, *Patent Prizes*, *supra* note 21, at 201-06.
[30] *See* Pénin, *Patents Versus Ex Post Rewards*, *supra* note 2, at 645-46;
[31] *See* Hemel & Ouellette, *supra* note 14, at 312-15; *see also* Ted M. Sichelman, *Commercializing Patents*, 62 STAN. L. REV. 341, 358-59 (2010); F. Scott Kieff, *Property Rights and Property Rules for Commercializing Inventions*, 85 MINN. L. REV. 697, 710 (2001).

in fact, it appears that in the United States invention is indeed incentivized by a combination of patent- and grant-based rewards.[32]

B. Patent Policy under a Rewards-Focused Patent System

Under the rewards view, the selection of patent rules will be driven by the trade-offs highlighted above. Increasing patent term, broadening patent rights, granting patentee antitrust immunities—all of these will tend to increase the expected wealth transfer to successful inventors, while also tending to impose additional deadweight losses.[33] In the other direction, changes in policies that limit the rights of patent holders will decrease their expected wealth transfer, while also reducing deadweight losses. In the standard rewards view, all of these rights and liabilities are essentially tradable; what one policy takes away, another policy may just as easily give back.[34]

In this way, there is a certain fungibility among patent policies as far as rewards go. A new antitrust immunity is theoretically interchangeable with a patent term extension—each will increase inventor rewards and impose deadweight losses.[35] As between the two, (and holding all else equal) the better policy is the one that provides the larger amount of inventor rewards at lower cost.[36] And, by extension, a policymaker could potentially improve the patent system by drastically reducing patentee antitrust immunities and increasing patent term (or vice versa). Thus a wide range of patent polices—application filing fees, patent term extensions, antitrust immunities, claim scope, and so on—implicate the same basic balancing of the net benefits of private patentee rewards versus public deadweight losses, and can be substituted one for the other as circumstances require.[37]

Of course, the interchangeability of policies at some margin does not imply that all the various levers for influencing the level of rewards provided by patents are equally desirable. As others have noted, some patent policies will be more or less likely to lead to undesirable levels of racing, vary in terms of the specific kinds of invention they incentivize, or have different consequences for incentives to create the *next* generation of technological improvements.[38] However,

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[32] *See* Hemel & Ouellette, *supra* note 14, at 306.
[33] *See* Kaplow, *supra* note 1, at 1830-32.
[34] *See* W. Nordhaus, INVENTION, GROWTH AND ECONOMIC WELFARE (1969); Richard Gilbert and Carl Shapiro, *Optimal Patent Length and Breadth*, 21 RAND J. ECON. 106, ___ (1990); Paul Klemperer, *How Broad Should the Scope of Patent Protection Be?*, 21 THE RAND J. ECON. 113, 114-16 (1990).
[35] *See* Kaplow, *supra* note 1, at 1855-67; Daniel A. Crane, *Intellectual Liability*, 88 TEX. L. REV. 253, 271-72, (2009).
[36] *See* Kaplow, *supra* note 1, at 1855-67; Scotchmer, *supra* note 22, at 109-11.
[37] *See* Scotchmer, *supra* note 22, at 107, 109-11 (discussing fungibility of patent term and breadth).
[38] *See* Merges & Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839, 869-70 (1990); Nancy T. Gallini, *Patent Policy and Costly Imitation*, 23 RAND J.

the complexity of these first- and second-order considerations does not change the basic question confronting the rewards-focused policymaker: how to create the most cost-effective bundle of exclusive rights and immunities to incentivize the creation of new inventions. While some policy levers may be more attractive answers to that question than others, almost any policy change affecting the level of inventor rewards can be offset by a corollary change in the same or a different domain.

As will be discussed in Part III, these principles of patent policymaking are markedly different than those implied by a coordination-focused view of the patent system. First, however, it is important to understand and define what the coordination function actually is.

II. WHAT IS THE COORDINATION FUNCTION?

For almost two centuries, the rewards function described in the prior section was the dominant (if not exclusive[39]) justification for the patent system. In more recent years, however, commentators have noted a variety of roles that may be served by a patent system beyond the transfer of wealth to the inventors of new technologies. Much of this literature has been motivated by a rather troubling empirical question: why do so many inventors apply for patents when so few patents turn out to have much enforcement value? The apparent inability of the traditional rewards view to fully explain the extent of participation in the patent system has led scholars to search more deeply for roles the patent system may be serving in practice.[40]

Because prior work examining alternate uses of the patent system has been largely focused on explaining the behavior of private actors, there has not been a pressing need to distinguish the boundaries where one function of the patent system ends and the other begins. Those participating in the patent system likely do so for a blend of reasons, and a novel observation about how the patent is being

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ECON. 52, 53 (1992) [hereinafter Gallini, *Patent Policy*]; Michael Abramowicz, The Danger of Underdeveloped Patent Prospects, 92 Cornell L. Rev. 1065, 1068-69 (2007) [hereinafter Abramowicz, *Underdeveloped Prospects*].

[39] As discussed below, the disclosure justification also has a storied provenance. *See infra* II.A.6.

[40] *See*, *e.g.*, Long, *supra* note 6, at 626-27; Pénin, *Patents Versus Ex Post Rewards*, *supra* note 2, at 642, 646-48. To be sure, in addition to the coordination-related explanations described below, there are a number of plausible answers to this question. *See*, *e.g.*, Gideon Parchomovsky & R. Polk Wagner, Patent Portfolios, 154 U. PA. L. REV. 1 (2005); Stuart J.H. Graham & Ted Sichelman, Why Do Start-Ups Patent?, 23 BERKELEY TECH. L.J. 1063, 1064-70 (2008); Bronwyn H. Hall & Rosemarie Ham Ziedonis, *The Patent Paradox Revisited: An Empirical Study of Patenting in the U.S. Semiconductor Industry*, 1979-1995, 32 RAND J. ECON. 101, 102 (2001); Lemley, *Rational Ignorance*, *supra* note 6, at 1504-06.

used by some actors hardly needs to be exclusive of any theory.[41] Further complicating matters, several of these functions are commonly associated with Kitch's far-reaching article, *The Nature and Function of the Patent System*. Although Kitch noted a variety of ways that the patent system could increase the output from resources used for technological innovation,[42] subsequent commentators have tended to discuss them all under the broad rubric of "prospect" (or sometimes "commercialization") theory, and have not consistently distinguished among these various, alternative uses of the patent system.[43]

While sometimes overlapping understandings of these functions have been suitable for prior descriptive projects, properly assessing the policy implications of these theories necessarily requires more specificity. Indeed, one goal of this Article is to understand exactly when and how one function of the patent system becomes exclusive of another function—and this, of course, is impossible to answer without clear conceptions of what those functions actually are.

To this end, this part will establish what this Article means by the term "coordination function." It begins by introducing several additional uses of the patent system that have been noted by prior commentators. To be clear, this list is by no means comprehensive—there is a substantial literature on alternative theories of patenting, and it would not be fruitful to reproduce it all here. Moreover, even within this condensed account, only some of these roles are properly considered within the coordination function. Others turn out to have more in common with the rewards function than might first appear.

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[41] *See*, *e.g.*, Long, *supra* note 6, at 637 (noting that prior explanations for patentee behavior are not incorrect, but "present an incomplete picture"); Kitch, *Nature and Function*, *supra* note 2, at 266; Dan Burk and Mark Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, 1615-30 (2003).

[42] *See* Kitch, *Nature and Function*, *supra* note 2, at 275-79.

[43] *See*, *e.g.*, Dan L. Burk & Mark A. Lemley, THE PATENT CRISIS AND HOW THE COURTS CAN SOLVE IT 69-72 (2009); Niva Elkin-Koren & Eli Salzberger, THE LAW AND ECONOMICS OF INTELLECTUAL PROPERTY IN THE DIGITAL AGE: THE LIMITS OF ANALYSIS 83 (2013). Moreover, the term "prospect theory" is often used as a shorthand for the patent policies Kitch initially suggested these functions would imply. *See* John F. Duffy, *Rethinking the Prospect Theory of Patents*, 71 U. CHI. L. REV. 439, 440-43 (2004) (describing the "prospect features" of patent law as "the rules permitting fairly broad patents to be issued in the early stages of technical development"); Donald G. McFetridge and Douglas A. Smith, *Patents, Prospects, and Economic Surplus: A Comment*, 23 J.L. & ECON. 197, 198 (1980); Abramowicz, *Underdeveloped Prospects*, *supra* note 38, at 1068, 1082-83; Sichelman, *supra* note 31, at 345. Because of these various ambiguities, this Article avoids the term "prospect" whenever possible, and attempts to make a crisper distinction between the coordination and commercialization roles of the patent system. *See infra* II.B.

A. Candidates for Coordination

1. Signaling

One alternative function that may be served by the patent system is signaling. As Clarissa Long and others have noted, by filing patent applications directed at a particular area, a company sends signals to capital and labor markets about its commitment to research and development.[44] These signals can be both magnitudinal and directional. A flurry of patenting activity around a particular technology can signal a firm's commitment to that technology, and success in obtaining patents may indicate that an individual or firm is more capable at conducting research and development than certain peers.[45] Similarly, patents may be useful not only for signaling outside a firm, but also for measuring the productivity of individual members with a firm.[46]

When used as signals, patents are a solution to a problem of asymmetric information with high verification costs. A company conducting research and development knows the level of its own investment and may have some sense of its achievements, but it is often difficult to communicate this information credibly to relevant constituencies outside the firm. In the absence of a patent system, outsiders would have to either discount the firm's claims of inventive success or invest substantial resources in verifying those claims. Under the signaling view, one reason firms seek patents may be to demonstrate that they have inventive achievements that are substantial enough to justify the costs of patenting.[47] Moreover, information contained in patent applications may be more reliable than other sources because applicants are subject to a duty of candor in patent proceedings, and may be incur penalties for misstatements made to the patent office.[48] And, because patents are only issued after substantive review by an outside agency, a patent grant may be a more credible indicator of success than a unverified public announcement.[49] In this way, patent grants may be operating as a kind of governmentally administered prize, marking a costly, independently confirmed achievement that many attempt but not all accomplish.

It is important to note that, at least as it has been conventionally presented, the signaling function of patents is based entirely on the information conveyed by the fact a firm has applied for and obtained patents. The signaling function described by Long explicitly does not rely on the ability of those issued patents to exclude, or the requirement to disclose information in the patent application itself.[50] If signaling were the *only* function of the patent system—a claim, to be

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[44] *See* Long, *supra* note 6, at 637; Silbey, *supra* note 3, at 458-60.
[45] *See* Long, *supra* note 6, at 646-50; Silbey, *supra* note 3, at 455-56.
[46] *See* Richard C. Levin et al., *Appropriating the Returns from Industrial Research and Development*, 3 Brookings Papers on Econ. Activity 783, 798 (1987).
[47] *See* Long, *supra* note 6, at 650, 667.
[48] *See id.* at 649-50.
[49] *See id.* at 667.
[50] *See id.* at 636-37.

clear, proponents of signaling theory do not make[51]—there would be no need to include the exclusive rights at all. To the contrary, the same problems of verification costs could be addressed by a system of peer-reviewed honors wholly apart from patenting.[52]

2. Reducing Risk in Transactions around Information

Another function that may be served by the patent system is the reduction of risk in transactions around information relating to technology. Anytime a firm shares information with value that depends on confidentiality, it puts some of that value at risk. The recipient may breach its promises, the information may be valuable in some way not captured by their agreement, or a third party may simply intercept the disclosure. As this theory goes, a patent's *in rem* exclusivity—its ability to restrain others without needing to show a contractual relationship or even a chain of direct copying—can mitigate the risks of sharing information with a counterparty, allowing for more efficient development and exploitation of new technologies.

There are a host of potential benefits tied up in this idea of patents reducing secrecy-related risk. Perhaps the simplest is that having patent protection as a fallback may reduce the costs of keeping secrets within a firm.[53] A strong patent portfolio may mitigate the risks and costs of misappropriation of confidential information, reducing the need for confidentiality agreements, physical protections, and intra-firm segregation.[54] It may also obviate the need to steer development efforts towards particular technologies or products for which secrecy is likely to be more effective.[55]

Patents may also reduce the perils encountered when transferring information *outside* the firm.[56] Without some kind of legal backstop, it can be quite difficult to bargain and trade for a secret. In some cases (though certainly not all[57]), it is impossible to set the price for information without knowing what the information is, and of course the price may fall to zero once the prospective buyer

[51] *See*, *e.g.*, Long, *supra* note 6, at 637.
[52] *Cf.* Pénin, *Patents Versus Ex Post Rewards*, *supra* note 2, at 651.
[53] *See* Heald, *Transaction Costs*, *supra* note 2, at 488-89; Kitch, *Nature and Function*, *supra* note 2, at 279.
[54] *See* Heald, *Transaction Costs*, *supra* note 2, at 488-89; Landes and Posner, *supra* note 2, at 328. As Dan Burk and Brett McDonnell have noted, the benefits of reduced reliance on trade secrecy and other precautions can accrue to employer and employee alike. *See* Dan L. Burk and Brett H. McDonnell, *The Goldilocks Hypothesis: Balancing Intellectual Property Rights at the Boundary of the Firm*, 2007 U. ILL. L. REV. 575, 608-09 (2007).
[55] *See* Kitch, *Nature and Function*, *supra* note 2, at 279; Landes and Posner, *supra* note 2, at 328.
[56] *See* Pénin, *Patents Versus Ex Post Rewards*, *supra* note 2, at 649.
[57] *See* Burstein, *supra* note 5, at 256-57.

has been given the information.[58] This creates the risk that valuable information may be inadvertently transferred without compensation during the negotiations period.[59] Patents may be able to provide an alternate source of protection around transactions, and thus facilitate the negotiated transfer of information from one firm to another.[60]

But the potential risk-reducing benefits of patents are not limited to transactions for the sale of technical information itself. It can also be quite difficult to arrange for services to be performed that merely require the *use* of confidential information.[61] Because of the challenges of contracting around information, possessors of valuable non-public knowledge may abstain from otherwise mutually beneficial transactions that could result in an accidental transfer. For example, a firm contemplating outsourcing some aspects of production or design may hesitate, given the risk that proprietary information will be misused by its prospective counterparty or otherwise shared with third parties. A strong patent portfolio on the underlying technology may allow a firm to disclose specific plans based on that technology more widely, allowing it to outsource non-core functions more readily, collaborate more closely with partners exploring complementary technology, and inform customers about new offerings at an earlier stage in the development process.[62]

According to this theory, an issued patent can reduce the risks in a transaction involving the patented invention itself—that is, the technology described in the patent specification that justified the patent grant in the first place. But it can also backstop transactions in other technical information that happens to

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[58] This challenge is known as Arrow's Information Paradox. *See* Arrow, *supra* note 17, at 614-16; James J. Anton & Dennis A. Yao, The Sale of Ideas: Strategic Disclosure, Property Rights, and Contracting, 69 REV. ECON. STUD. 513, 514 (2002). And, to be perfectly clear, because the nature of information varies, this issue is more serious in some types of transactions than others. *See* Burstein, *supra* note 5, at 274; Anton & Yao, *supra* note 58, at 514-15.

[59] *See* Merges, *Transactional View*, *supra* note 3, at 1487-90; Janusz Ordover, *A Patent System for Both Diffusion and Exclucion*, 5 J. ECON. PERSP. 43, 50 (1991).

[60] *See* Landes & Posner, *supra* note 2, at 329. Variants of this argument are sometimes categorized under the disclosure function of patents, *see*, *e.g.*, Rebecca Eisenberg, *Patents and the Progress of Science: Exclusive Rights and Experimental Use*, 56 U. CHI. L. REV. 1017, 1029-30 (1989). However, for reasons explained below, this association can be misleading. *See infra* II.A.6.

[61] *See* Kitch, *Nature and Function*, *supra* note 2, at 277.

[62] *See* Kitch, *Nature and Function*, *supra* note 2, at 277-78; Heald, *Transaction Costs*, *supra* note 2, at 498-97; Pénin, *Patents Versus Ex Post Rewards*, *supra* note 2, at 650. For a discussion on the relationship between transactions costs and vertical integration, *see* Benjamin Klein et al., *Vertical Integration, Appropriable Rents, and the Competitive Contracting Process*, 21 J.L. & Econ. 297, 298 (1978); Robert P. Merges, *Intellectual Property and the Costs of Commercial Exchange: A Review Essay*, 93 MICH. L. REV. 1570, 1573-74 (1995) [hereinafter Merges, *Costs of Commercial Exchange*]. For a discussion of similar benefits in the context of trade secrecy, *see* Lemley, *Surprising Virtues, supra* note 15, at 335-36.

fall within the scope of the patent's exclusivity—not only potentially helpful know-how that was omitted from the original disclosure, but also further developments that might have been made well after the patent was filed.[63] Thus a single patent can facilitate repeated transfers of a variety of information, both for the technology that constituted the original invention, as well as for follow-on improvements and more specific design details.

In this role, patents are a solution to some of the specific challenges of using contracts to arrange transactions around information. For a host of reasons—the difficulties of describing information precisely, evidentiary uncertainty, and the constraints of contractual remedies, to name a few[64]—there are limits to the abilities of any two parties to mitigate these risks by mutual agreement. This is not to say it would be impossible to conduct any transactions at all around technology in the absence of patent protection—of course there are some transactions that will occur either way.[65] The theory, rather, is that a framework of exclusive rights can reduce the risks involved in evaluating, entering, and enforcing agreements involving the exchange of information.[66] And by reducing the cost of such transactions, patents may allow more mutually beneficial bilateral arrangements to transpire.

3. Facilitating Multilateral Collaboration

Another potential benefit of the patent system is that it may facilitate multilateral collaboration. In the absence of intellectual property protection, it can often be difficult to share technology with the outside world without losing control of it completely. As a result, firms that might otherwise benefit from transparency and collaboration instead opt for secrecy and isolation, making partners more difficult to identify, creating a risk of unproductive duplicative investment, and

[63] Although in theory a firm must choose between patent protection (which requires disclosure) and trade secrecy (which forbids it), in practice this line is blurry, and many firms are able to "have it both ways" by disclosing enough to get a patent while also keeping valuable, related information as a trade secret. *See* Ted M. Sichelman & Stuart J.H. Graham, *Patenting by Entrepreneurs: An Empirical Study*, 17 MICH. TELECOMM. & TECH. L. REV. 111, 136 (2010) [hereinafter Sichelman & Graham, *Patenting by Entrepreneurs*]; Michael Risch, *Trade Secret Law and Information Development Incentives*, *in* THE LAW AND THEORY OF TRADE SECRECY 169 (Rochelle C. Dreyfuss & Katherine J. Strandburg eds., 2011) [hereinafter Risch, *Trade Secret Law*].

[64] *See* Merges, *Transactional View*, *supra* note 3, at 1491-93, 1497-98, 1503-04; Kitch, *Nature and Function*, *supra* note 2, at 278; Heald, *Transaction Costs*, *supra* note 2, at 480-81; Edmund W. Kitch, *The Law and Economics of Rights in Valuable Information*, 9 J. LEGAL STUD. 683, 690-93 (1979).

[65] *See* Burstein, *supra* note 5, at 256-57.

[66] *See* Merges, *Transactional View*, *supra* note 3, at 1484-85; Merges, *Costs of Commercial Exchange*, *supra* note 62, at 1589-91; Pénin, *Patent Policy*, *supra* note 3, at 124; Sichelman & Graham, *Patenting by Entrepreneurs, supra* note 63, at 129-30.

jeopardizing potential opportunities for specialization.[67] One benefit of the patent system, this theory goes, is that a framework of *in rem* exclusive rights may enable those who possess valuable new technologies to open up the development process to outsiders without losing the ability to control the resulting uses. Thus, patents may not only be useful for backstopping bilateral exchanges (the individual-to-firm and firm-to-firm contracts discussed in the prior section), but also for coordinating ownership of technical information in a multilateral environment.

There are several ways that patents may facilitate this kind of collaboration. The first is by enabling earlier, wider, and more candid disclosure. In the absence of patent protection, a firm with non-public technical information may rely more heavily on secrecy to preserve its advantage.[68] To some extent, this theory dovetails with the one stated previously: that a strong patent portfolio may allow that firm to engage in more bilateral transactions requiring use of that confidential information by offering protection against misappropriation by counterparties.[69] But more than that, a background of patent rights may allow a firm to share more information across the relevant industry, even to parties with whom the firm does not have a contractual relationship.[70] This increased transparency may allow others in the industry to adjust the level and direction of their development efforts, reduce redundant investments, lower search costs, and enable cooperation earlier in the development process.[71]

Another way patents may facilitate multilateral collaboration is by making it easier to form joint ventures. One of the well-known risks in joining a research partnership is that the collaboration may result in the inadvertent transfer of existing information from a firm to its partners—or, conversely, may lead to the false claim by one of the partners that it owns something that in fact one of the other partners brought to the table.[72] Patents can be used to define and protect the technology that each party possessed prior to the partnership, reducing the risk of misappropriation or opportunistic behavior on the part of its collaborators.[73] On the other end of the joint venture lifecycle, patents may also provide a solution to the challenge of dividing the fruits of the partnership. One of the limits of concretely

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[67] *See* Kitch, *Nature and Function*, *supra* note 2, at 278; Pénin, *Patent Policy*, *supra* note 3, at 122; Merges, *Transactional View*, *supra* note 3, at 1519.
[68] *See* Kitch, *Nature and Function, supra* note 2, at 278; Ordover, *supra* note 59, at 49-50.
[69] In other ways, it dovetails with the disclosure-enabling function of patents, although this explanation requires a slight bit of refinement. *See infra* II.A.6.
[70] *See* Mazzoleni & Nelson, *supra* note 3, at 1039; Merges, *Transactional View*, *supra* note 3, at 1487-90; Kitch, *Nature and Function, supra* note 2, at 278; Fed. Trade Comm'n, To Promote Innovation: The Proper Balance of Competition and Patent Law and Policy, at 18, ch. 3 (2003), *available at* http://www.ftc.gov/os/2003/10/innovationrpt.pdf [hereinafter FTC Report]; Bureth, *supra* note 4, at 7.
[71] *See* Kieff, *Coordination*, *supra* note 7, at 345-46; Landes & Posner, *supra* note 2, at 329.
[72] *See* Merges, *Costs of Commercial Exchange*, *supra* note 62, at 158; Bureth, *supra* note 4, at 8-9; Pénin, *Patent Policy*, *supra* note 3, at 124; Ordover, *supra* note 59, at 55-56.
[73] *See* Pénin, *Patents Versus Ex Post Rewards*, *supra* note 2, at 650; Pénin, *Patent Policy*, *supra* note 3, at 124; Merges & Arora, *supra* note 3, at 458-59.

dividing the output of a joint venture by contract is that, at the time of the partnership's formation, the information at issue typically does not yet exist.[74] Pre-committing the joint venture's innovations to patents can work as an at least partial solution to this problem. Patent law may thus not only reduce the risk of an unplanned transfer of existing information through a partnership, but also enable the partitioning of future information that may result from that partnership.

As with the transactions risk-reducing role discussed in the prior section, it would be unnecessarily limiting to focus only on a patent's role in facilitating sharing and partitioning of information that is described in the patent document itself. Rather, patents may enable broader disclosure and more nuanced ownership of a wide range of technical information that falls within their bounds of exclusivity. An old patent with a mostly outdated specification, for example, might nonetheless enable a firm to disclose important new information that falls within the scope of that patent's claims.

Under this theory, patents may allow for the sharing of information in a variety of contexts in which contracts are likely to be incomplete or unavailable. For example, if a firm wants to announce an important technical development broadly in hopes of identifying potential partners, it may not be practical to contract with all the relevant recipients to establish the terms of that disclosure—particularly if the whole point of the announcement is to discover previously unknown candidates for collaboration. Similarly, if hundreds of competitors want to coordinate to develop a new industry standard, it may very well be impossible to contractually settle exactly who-owns-what as a prerequisite to technical discussions. As technology becomes more complex and firms more specialized, the incidence of these issues only increases.[75] A background of exclusive rights, the theory goes, may allow for smoother multilateral exchanges of information, reducing duplicative efforts and enabling innovations that no firm would be able to achieve on its own.[76]

4. Commercialization Incentives

Another purpose the patent system may serve is the encouragement of the continued investment in technologies *after* their initial invention. Many technologies require significant investment to go from proof of concept to being widely available on the market.[77] In the absence of patent protection, an inventor may hesitate to invest in this process given the ease with which his competitors could appropriate the benefits of that investment.[78] Under the commercialization incentives view, in addition to any rewards a patent may provide to invent in the

[74] *See* Bureth, *supra* note 4, at 8-9, 17-18.
[75] *See* Pénin, *Patent Policy*, *supra* note 3, at 122.
[76] *See* Pénin, *Patent Policy*, *supra* note 3, at 111; Landes & Posner, *supra* note 2, at 329.
[77] *See* Sichelman, *supra* note 31, at 348-54.
[78] *See* Mazzoleni & Nelson, *supra* note 3, at 1040; Sichelman, *supra* note 31, at 353-54, 372-74.

first place, a patent may also enable an inventor to capture more of the returns of investing in commercialization and other post-patenting refinements.[79] Patents may thus play an important role in transferring the benefits of improvement and commercialization back to those making these investments, increasing the level of investment in these improvements overall.

As just described, the commercialization-incentives justification for patents is not so different from the traditional explanation that patents are important for rewarding invention. In both cases, patents are a solution to the difficulty of appropriating the returns from investments in research and development.[80] The distinction is in the type and timing of the improvement to be rewarded. In the traditional rewards case, something of value (a patent) is granted after the sought-after goal (a patentable invention) has been accomplished. In the commercialization view, the thing of value is the same (still a patent), but its worth is determined later based on the holder's success or failure in achieving market adoption of the patented technology. In this way, the observation that patents may provide incentives to commercialize does not so much change the basic model of patents as rewards, but rather expands the scope of what kinds of investments they can be used to reward.[81]

As others have noted, there are a variety of policy options that could alternatively serve this purpose of creating incentives to commercialize—grants, prizes, tax breaks, other forms of subsidies—essentially the same suite of alternatives to patents that could be used to reward the initial steps of invention.[82] However, the observation that patents can create incentives both to invent and to commercialize reveals one potential advantage of patents over other forms of direct rewards. Once commercialization incentives are considered, patents look like a one-step governmental intervention that goes a long way, both rewarding the initial invention and allowing the inventor to capture the benefits of continued investment in the technology. Achieving the same benefits through a system of prizes, by contrast, could require successive rounds of administrative action.[83]

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[79] *See* Kitch, *Nature and Function*, *supra* note 2, at 276; Abramowicz, *Underdeveloped Prospects*, *supra* note 38, at 1067; Kieff, *supra* note 31, at 707-10.

[80] *See* Mazzoleni & Nelson, *supra* note 3, at 1033, 1040.

[81] *See* Eisenberg, *supra* note 60, at 1037; Burstein, *supra* note 5, at 241.

[82] *See* Camilla Hrdy, *Local Commercialization Incentives* at ___ (2014), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2404741.

[83] Some have argued that the existing system of early-stage patent grants does not created sufficient incentives to see an invention through to commercialization, suggesting that an additional, second-stage patent grant or extension may in some circumstances be beneficial. *See* Sichelman, *supra* note 31, at 400-11; Abramowicz, *Underdeveloped Prospects*, *supra* note 38, at 1110-14; *see also* Michael Risch, *Reinventing Usefulness*, 2010 B.Y.U. L. REV. 1195, 1248-50 (2010) (nothing that this problem could be addressed by increasing the threshold of patentability). Others have questioned the need to use the patent system to provide commercialization incentives. *See*, *e.g.*, Lemley, *Myth*, *supra* note 5, at 739-45.

To be clear, patents may play other roles in the commercialization process beyond providing direct incentives to commercialize. For example, some commentators have noted that patents may facilitate commercialization by enabling transfer of technologies from those with the capacity to invent to those with the capacity to bring products to market.[84] However, this kind of patent-backed technology transfer from research lab to industry is really just an example of the transaction risk-reducing and collaboration-facilitating benefits of patents described in the prior sections. This is not to diminish the importance of these transactions; rather, it is simply to distinguish between the role patents play in creating incentives to commercialize and the role patents play in facilitating transactions that may result in commercialization.

5. Reducing Competition for Innovation

Although many of the roles introduced above can be traced in some way to Kitch's *Nature and Function of the Patent System*, there is still another justification that is perhaps more closely associated with Kitch's work than any of the others. This is the idea that a patent can reduce competition for innovation—and that this reduction in competition can actually lead to more efficient development of new technologies.[85]

In its basic form, the goal of reducing competition for innovation is focused on avoiding wasted efforts. As the argument goes, when firms compete to develop the same technology, they often duplicate each other's work, resulting in inefficient investment.[86] This is not simply an information failure, for the same thing could occur even if all the relevant firms knew exactly what the others were doing.[87] Patents may reduce this inefficiency, the theory goes, by vesting a patent "prospector" with unilateral control over future uses of a particular technology. This puts the prospector in a position to mastermind the search for improvements, reducing duplicative efforts and allowing firms to direct their work at the problems that most urgently need to be solved.[88]

This aspect of Kitch's work is most controversial. Many have questioned what it is about the market for innovation that justifies a departure from ordinary, pro-competition principles.[89] Others have noted that the interests of these private

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[84] *See* Mazzoleni & Nelson, *supra* note 3, at 1040; Landes & Posner, *supra* note 2, at 329.
[85] *See*, *e.g.*, Duffy, *supra* note 43, at 440-43; Landes & Posner, *supra* note 2, at 319-20 (emphasizing this aspect of Kitch's contribution).
[86] *See* Kitch, *Nature and Function*, *supra* note 18, at 276.
[87] After all, what distinguishes this theory from the others is that it is the intensity of competition itself that leads to inefficient investment. To be sure, however, the difficulty of knowing which problems others are pursuing and what things they've tried may certainly exacerbate the problem. *See id.*
[88] *See id.*; Scotchmer, *supra* note 22, at 152 (summarizing Kitch's theory).
[89] *See* Merges & Nelson, *supra* note 38, at 872-74; Mark A. Lemley, *Economics of Improvement in Intellectual Property Law*, 75 TEX. L. REV. 989, ___ (1996) [hereinafter Lemley, *Economics of Improvement*]; Lemley, *Free Riding*, supra note 24, at ___ .

prospectors do not necessarily align with the interests of society at large, and may result in lessened competition in the subsequent market for improvements.[90] And, as many have observed, the theory has serious descriptive weakness, as current U.S. law does little to discourage improvers from making their investments first and negotiating with the prospector later.[91]

For present purposes, it isn't necessary to revisit these arguments about the desirability of reducing competition in a particular field of innovation. What is important to note, however, is that there is a distinction between using patents to facilitate better sharing of information in the search for improvements (*see supra* II.A.3) and using patents to reduce the competiveness of that search. The former is a mechanism for improving firms' abilities to collaborate voluntarily, when it is their mutual interest to do so. The latter is a means of changing the competitive structure of an industry, based on a belief that ordinary principles of competition would lead to an inefficient outcome in a particular set of circumstances. As such, the two are designed as solutions to markedly different problems, and result quite different theories of how patents should operate in practice.[92]

6. Disclosure

Of the various non-rewards justifications for the patent system, disclosure has by far the longest history. The Supreme Court mentioned disclosure as a goal of the patent system as early as 1832, and has repeatedly described disclosure as a core component of the patent bargain, sometimes even as *the* consideration offered by the patentee in exchange for exclusive rights.[93]

The challenge with this storied legacy is that "disclosure" has over time been invoked to mean very different things. In one sense, the term may refer to patent law's requirements that an applicant include a written description of her invention in such clear, concise, and exact terms as to enable a person skilled in the art to make and use the invention.[94] This is the traditional understanding of patent law's role in encouraging disclosure—the disclosure legally required as part of the quid pro quo of a patent grant.[95] And, if this is what the disclosure function means,

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[90] *See* Scotchmer, *supra* note 22, at 152-55.
[91] *See* Lemley, *Economics of Improvement*, *supra* note 89, at 1047; Duffy, supra note 43, at 483-84; Roger L. Beck, *Prospect Theory of the Patent System and Unproductive Competition*, 5 RES. L. & ECON. 193, 195 (1983).
[92] *See infra* notes 109-111 and accompanying text. Moreover, this proffered justification for the patent system should be further distinguished from the important task of tailoring the degree and form of racing while implementing a rewards-focused patent system. For thorough discussions of the issues involved in shaping the competition for a patent prize, *see* Duffy, *supra* note 43, at __; Abramowicz, *Patent Prizes*, *supra* note 21, at ___.
[93] *See* Grant v. Raymond, 31 U.S. 218, 247 (1832); Sinclair & Carroll Co., Inc. v. Interchemical Corp., 325 U.S. 327, 331 (1945); Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 481 (1974).
[94] 35 USC § 112(a) (2012).
[95] *See* Mazzoleni & Nelson, *supra* note 3, at 1039.

the success or failure of the patent system in achieving disclosure can be measured based on the value of the information contained in patent applications.[96] In another sense, however, "disclosure" can refer to the patent system's ability to facilitate disclosure *outside* patent documents.[97] As the theory goes, a system of *in rem* exclusive rights may facilitate publication and exchange of technical information that would otherwise have to remain confidential to preserve its value to its owner.[98] For this meaning of disclosure, the question of the patent system's success turns not on the quality of the disclosure in patents, but rather on the ease and frequency with which patent holders share information with the public or others in their industry as a result of having patent protection in place.[99]

Thus there are really two distinct concepts joined together under the rubric of disclosure: one in which the patent system is disclosure *forcing*, and another in which the patent system is disclosure *enabling*. And these two are rooted in quite different theories about the problem to be solved by the patent system. The disclosure-forcing argument for patenting is based on a concern that, in the absence of patents, secrecy would give inventors *de facto* exclusive control over their inventions for an indefinite period of time. From this perspective, it is preferable to give inventors time-limited exclusive rights rather than to let them keep them secret forever. But this begs the question: if an inventor has the option of indefinite secrecy, why would she opt in to the temporary exclusivity regime of the patent system in the first place? Without some other reason to patent, it would seem that the inventors who would be most likely participate in the patent system would be those with inventions that would quickly become public anyway. For this reason, many commentators have concluded that the disclosure-forcing aspects of patent law should not be considered a freestanding justification for the patent system, but rather as legitimate policy choices in light of the fact that (for other reasons) we have a patent system.[100]

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[96] *See* Ouellette, *supra* note 93, at 557-59; *The Disclosure Function of the Patent System (or Lack Thereof)*, 118 HARV. L. REV. 2007, 2014 (2005); C.T. Taylor & Z.A. Silberston, THE ECONOMIC IMPACT OF THE PATENT SYSTEM: A STUDY OF THE BRITISH EXPERIENCE 210-13 (1973).

[97] *See* Pénin, *Patents Versus Ex Post Rewards*, *supra* note 2, at 651 (making this distinction).

[98] *See* Mazzoleni & Nelson, *supra* note 3, at 1039-40.

[99] *See* FTC Report, *supra* note 70, at 18, ch. 3 (making a similar distinction); Burk & McDonnell, *supra* note 53, at 610; *Disclosure Function, supra* note 5, at 2014; Lemley, Myth, supra note 5, at 745-49.

[100] *See*, *e.g.*, Eisenberg, *supra* note 60, at 1029-30; Sichelman, *supra* note 31, at 377-78. This line of thinking typically results in the disclosure-forcing aspects of patent law being seen as a kind of appendage to the rewards justification. For example, even if the primary purpose of the patent system is to reward invention through a time-limited grant of exclusive rights, the disclosure obligations may still have an important role to play in ensuring that the invention indeed passes to the public domain at the end of the patent term. Along similar lines, it may be worthwhile to compel disclosure as a condition of the patent grant to stimulate further development and assist others attempting to invent around the

The disclosure-*enabling* argument for patenting, by contrast, is focused on the concern that, in the absence of patents, the risk of losing control over useful technical information would force firms to maintain this information as a secret notwithstanding existing reasons for those firms to share it with others. The goal of enabling disclosure is not to artificially encourage disclosure for its own sake, but rather to facilitate the exchange of information when it is already privately desirable to do so.[101]

This should sound familiar, however. Reduced to this description, the disclosure-enabling justification for the patent system is essentially a restatement of the transactions risk-reducing and collaboration-facilitating arguments already described above. And, as the next section will explain, these also happen to be the roles of the patent system that form the core of the coordination function.

B. Defining the Coordination Function

The prior sections have introduced a variety of potential uses of the patent system beyond the traditional explanation that patents provide incentives to invent. This section turns to the question of whether there is any commonality among these theories, a shared principle that can be used to inform patent policymaking.

Although the uses of the patent system described above are varied and in many ways divergent, they can for the most part be reduced to two basic theories of operation. The former are uses of the patent system that seek to induce private behavior through the promise of some publicly granted prize—in a word, rewards. The latter are uses of the patent system that seek to reduce the costs and risks associated with sharing and transacting around information relating to technology—essentially patents as tools for private coordination.[102] For purposes of the ensuing discussion, the coordination function includes any use of the patent system that facilitates the transfer of technical information from one party to another, whether by enabling public disclosure or reducing the risks inherent in bi- or multilateral agreements involving the exchange of information. Importantly, the coordination function includes transfers of information whether or not that information is included in the patent document itself, so long as the usefulness of that information can be controlled by the patent's exclusive rights. In this way, the coordination function can facilitate transfer of know-how that was omitted at the time of filing, as well as later-developed improvements and design details.[103]

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patented technology during the patent term. *See* Jeanne Fromer, *Patent Disclosure*, 94 IOWA L. REV. 539, 548-49 (2009); Lemley, *Surprising Virtues*, *supra* note 15, at 332 & n.87.

[101] *See* Mazzoleni & Nelson, *supra* note 3, at 1039.

[102] The theory that cannot be neatly categorized in this way is the function of reducing competition for follow-on innovation, *supra* II.A.5. For a discussion of this issue, *see infra* notes 110-111 and accompanying text.

[103] *See supra* n. 63 and accompanying text.

To be sure, both the rewards function and the coordination function of the patent system are motivated by the difficulties of excluding others from information. But whereas the rewards function is directed at the difficulty of appropriating the returns on research and development (and the accompanying concern that without some form of regulatory action, there will be underinvestment in such activities), the coordination function is at its core a remedy for the high transactions costs and difficulty of privately ordering around emerging technologies. In this way, the coordination function can be thought of as a bottom-up approach to the challenges of exclusion around information, focused on facilitating output-enhancing interactions among private actors, while the rewards function is more like a top-down attempt to directly influence the relevant output through subsidization.[104]

This distinction produces several intuitive results and several surprising ones. First, and as expected, the traditional purpose of using patents to incentivize invention is indeed a reward function—at core, it is an attempt to increase investment in research and development through targeted wealth transfer. Conversely, the transactional risk-mitigation and collaboration-facilitating roles of the patent system are within the core of the coordination function, as they are initiatives to increase productive interactions among private actors.

The interesting cases are the ones between these posts. Several of the more recently recognized, alternative uses of the patent system have more in common with the traditional rewards function than might first appear. For example, at least as described by Clarissa Long, the signaling value of patents is really an additional explanation for why inventors may cherish the patent prize. In exchange for satisfying the statutory requirements of patentability, the inventor is granted a public honor that she may cite on her resume, in investor reports, and so on. Long's insight is a simple one: that the value promised to successful inventors may come from more than simply a patent's legal right to exclude.[105] This view is entirely consistent with a goal of awarding patent prizes as a way of encouraging particular accomplishments.

Another important consequence of this distinction is that the patent system's role in creating incentives to commercialize *after* patenting can also be described as a modified form of the rewards function. At heart, the commercialization-incentivizing function of the patent system is a solution to the problem of appropriating the returns from further investments in development. In

[104] Julien Pénin has articulated a very similar distinction between solutions to "appropriation failures" and solutions to "coordination failures." *See* Pénin, *Patent Policy*, *supra* note 3, at 125. I agree with his basic distinction, but prefer the term "rewards" for the first category because of the potential for confusion about the kind of appropriation failures at issue. After all, *both* the need to reward invention and the need to provide mechanisms for coordination around information arise as a result of the risk that others may appropriate the benefits of an investment in research without compensation.

[105] *See* Long, *supra* note 6, at 636-37.

this way, it is really another flavor of the appropriation problem motivating the traditional rewards function, and likewise could be addressed either by a system of exclusive rights or by a system of prizes, grants, or other interventions to subsidize the same efforts.[106]

As for the ambiguously defined "disclosure" function, whether it belongs within the reward function or within the coordination function depends on the sense in which the term is used. The disclosure-forcing aspects of patent law plainly embrace a reward-centric quid pro quo—a publicly granted subsidy in exchange for the desired form of disclosure.[107] The disclosure-*enabling* aspects of patent law, by contrast, are focused on providing tools for the mutually beneficial exchanges of information among private actors, and thus should properly be considered within the realm of the coordination function. This divergence only underscores the importance of greater clarity about what is meant by "disclosure," as the two uses of the term refer to very different theories of operation and imply very different kinds of policies.[108]

Notably, the theory that patents can beneficially reduce competition for innovation defies this system of rewards-versus-coordination categorization.[109] This is because the goal of reducing competition is not rooted in a market failure relating to the difficulties of excluding other from uses of information. There may or may not be situations where centralized control of innovation is more efficient than decentralized control, but that question is quite apart from the various concerns motivating the rewards and coordination functions. For this reason—and despite its common origin with uses of the patent system that *are* within the coordination function[110]—it is best considered as a third theory, separate from either rewards or coordination. And, tellingly, contemporary proponents of the coordination function do *not* embrace this goal of reducing competition in the

[106] A point of clarification is in order. Although the basic structure of the commercialization-incentivizing theory is the same as the invention-incentivizing theory, the goals of the two are different, and commercialization-rewarding policy would potentially diverge significantly from invention-rewarding policy. The discussion following in the rest of this paper is limited to the latter of these two: the traditional justification of granting patents as a reward for prior invention. An analysis of the implications of commercialization-incentivizing-focused patent policy is beyond the scope of this Article, though a ripe domain for future work.

[107] Indeed, the more common view today is that the disclosure obligations of patent law are best understood as appendages to the rewards function, since they cannot justify the system on their own. *See supra* n. 100.

[108] The differences in the rewards and coordination theories and resulting patenting policies are developed at length in Parts III and IV.

[109] *See supra* II.A.5.

[110] *See* Kitch, *Nature and Function*, *supra* note 2, at 276-79.

market for follow-on innovation, suggesting it is indeed coming to be recognized as a distinct theory.[111]

One important consequence of the distinction between rewards and coordination articulated above is that the two functions generally have different substitutes. All of the various problems solved by the rewards function could alternatively be addressed through a prized-based system. For example, if a policymaker wanted to increase incentives to commercialize undeveloped inventions, she could institute an additional grant-based system to do so. (By contrast, however, increasing the penalties for disclosing trade secrets wouldn't necessarily increase incentives to search for a solution to a particular problem.) And, similarly, many of the coordination problems could potentially be addressed through stronger enforcement of bilateral agreements around uses of information. (Likewise, a cash grant for accomplishing a particular result wouldn't necessarily make the search for a solution any more collaborative.[112]) This is not to say that these substitutes are equally effective—only that reward problems can typically only be addressed by incentive-increasing solutions, and coordination problems can typically only be addressed by information-exchange-facilitating solutions. It just so happens that the patent system can (in theory) be used to address either category of concern.

C. A Word of Caution

Although the prior section has attempted to bring some clarity to the question, it is important to note that there is no universally accepted definition of coordination. Commentators discuss the coordination role of patents in a variety of contexts, and it is not always clear whether a particular use of the patent system is best described as a coordination function, a rewards function, or something else entirely. The definition of coordination offered above is narrower than some have conceived of it, and, as a result, one may argue that there are important coordination-related uses of the patent system that it improperly excludes.

One advantage of the definition of coordination chosen above is that it leads to a coherent, functional core. The transactional risk-reducing, collaboration-facilitating, and disclosure-enabling aspects features of the patent system share a common method of operation; they solve the same kind of market failure; they have similar policy substitutes. As a result, and as the balance of this Article will

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[111] For example, Merges notes various coordination advantages to patents, *see* *Transactional View*, *supra* note 3, at 1484-85, 1487-93, 1497-98, & 1503-04, but directly challenges the theory that it is useful to reduce competition for follow-on innovation. *See* Merges & Nelson, *supra* note 38, at 872-74. Landes and Posner similarly embrace uses of the patent system that fall within the coordination function, while doubting the benefits of centralizing control of development efforts in a single prospector. *See* Landes & Posner, *supra* note 2, at 319-20. *See also* Pénin, *Patents Versus Ex Post Rewards*, *supra* note 2, at 548-51.

[112] *See* Pénin, *Patents Versus Ex Post Rewards*, supra note 2, at 653-54.

show, this proves to be a useful grouping for spelling out the policy implications of a choice to emphasize and encourage these use of the patent system.

Because this definition is contestable, one must be careful about how the conclusions of this Article are used. If one subscribes to a broader definition of the coordination function, there may be important coordination-related uses of patents that the following analysis does not consider. And indeed, some of these additional uses may have different policy implications than those described below. Even so, this does not undermine another central argument of this Article: that coordination-focused policy is capable of significant divergence from rewards-focused policy, and that further work exploring the applications of coordination-focused policy is necessary before one can reach a firm conclusion about the desirability of using the patent system in this way. Once this much is established for a core theory of coordination, it is quite possible that it could be expanded to include other coordination-related features as well.

With the coordination function thus defined (and these caveats in place), the next part will delve deeper into how this function operates and what its recognition would imply more generally for patent policy.

III. THE COORDINATION FUNCTION: FROM THEORY TO MID-LEVEL PRINCIPLES

Although prior commentators have suggested a variety of ways that patents can be used to facilitate coordination, there is another step necessary to integrate these potential benefits into a unified theory of operation that can be used to inform patent policy. To this end, this part begins by developing a framework of how the coordination function provides its purported benefits. It then highlights several important distinctions between this theory and its rewards equivalent, noting how each function tends to rely on different aspects of the patent system.

A. A Model of the Coordination Function

As discussed above, there are a variety of ways that patents can facilitate the exchange of sensitive technical information. Patents could reduce the need for precautions to keep secrets within a firm, alleviate risks on both sides in a transaction for information, or offer a fallback strategy in case of a breach of an arrangement that requires giving a counterparty limited or conditional use of some confidential information. Similarly, patent protection may enable earlier, wider, and more candid disclosure, either to a close group of partners or to the world at large.

Although the coordination function encompasses various ways in which patents may facilitate exchanges around confidential information, these can all be reduced to a common method of operation: patents reduce the risk that purposefully or inadvertently exchanged information will later be used in ways its original possessor does not intend and did not bargain for. The coordination

function enables more bargained exchanges and broader disclosure by providing an alternate means of exclusion when secrecy and contracts fail or are otherwise unavailable.

To put this into more concrete terms, the need for exchange begins when a firm possesses confidential information with value that depends on whether it remains under the control of the firm. Call this control-dependent value S—the private value that will be lost if the information is transferred, divulged, or otherwise used in a way the firm does not intend. To use a simple example, consider the design plans for a new product ready to be launched to the market. If those design plans are kept safely under lock and key so that no competitors can use them to manufacture an identical product, the plans will have a particular value to the firm that created them. If the plans are somehow disclosed to competitors, they may still have value to the firm, but that value will be diminished because—in the absence of protection—others with access to the plans will be able to manufacture the product themselves. The difference between the value of the information when the firm maintains control over its use and when the firm loses control over its use is S.

At its core, the coordination function of the patent system seeks to influence the way firms protect or share confidential information by providing an alternate means of exclusion. In the absence of patent protection, a firm possessing confidential information with control-dependent value S will have to weigh the expected benefits of sharing (or reducing precautions to protect[113]) that information against the expected risk that the firm will lose that control-dependent value. For example, suppose the firm introduced above is considering outsourcing production of the new design to a third-party manufacturer. Outsourcing production is an information-sharing initiative with expected benefits (B), but that also carries a risk d (a probability between 0 and 1) that the plans will be disclosed to competitors. If this occurs, the control-dependent value (S) will be lost.[114] But if everything goes well (*i.e.*, the outsourcing goes forward successfully without the plans being divulged to third parties), the firm will be better off by B. The firm will thus engage in the information-sharing activity provided that the expected benefits of the activity outweigh the expected risk of losing the information's control-dependent value, that is, so long as $B > dS$.

Manipulating this equation, it becomes apparent that the fate of any given information-sharing activity (i) with benefits (B_i) and risks of divulgence (d_i) will turn on the value of the information it puts at risk. Information with little control-dependent value will satisfy $S < \frac{B_i}{d_i}$ for many kinds of information-sharing

[113] Throughout this discussion, the term "information sharing" is used to include both a deliberate transfer of information and a reduction in precautions to prevent transfer. Each is a decision by a firm to loosen its grip on some valuable information.

[114] This example assumes there is no other legal remedy available. This assumption can be relaxed by treating S as the residual control-dependent value that cannot be restored by non-patent remedies.

activities, and thus will be widely shared—either purposefully, or through reduced investment in secrecy-preserving precautions. As the value of the secret increases, however, some information-sharing activities will begin to fail this condition, and the firm will accordingly become more protective. For information with substantial control-dependent value, there may be few (if any) information-sharing practices with sufficiently large benefit-to-risk ratios ($\frac{B_i}{d_i}$) to justify undertaking them. In these cases, one would expect the firm to take extreme precautions, such as strict non-disclosure agreements, elaborate physical protections, intra-firm segregation, and engagement with outside parties only when it is extremely profitable for the firm to do so.

On certain conditions, a patent portfolio can change this calculus and cause the firm to engage in more information sharing than it otherwise would. When promises are broken or the previously-confidential information is used in a way the original possessor did not intend, the firm can attempt to restore exclusivity through the patent system. Bringing a patent infringement suit against those using the previously-confidential information will impose an enforcement cost (C), but offer a probability (p) of restoring some degree of exclusivity of value (X). So, whereas divulgence used to mean a loss of the full value of S, it will now result in a loss of $S + C$, potentially offset by patent-based exclusivity with expected value pX.[115] With a patent strategy to use as a fallback, the firm will now engage in an information-sharing activity (i) that satisfies the condition $B_i > d_i(S - pX + C)$.

The promised benefit of the coordination function is that it can reduce the effective risk a firm incurs by sharing or reducing precautions around information. To return to the example above, in the absence of patents, the firm contemplating outsourcing the manufacture of its new product would only do so if the control-dependent value of those plans was small compared to the benefits of outsourcing and the risk of divulgence, that is, if $S < \frac{B}{d}$. But add in the possibility that patents can be used to mitigate the firm's losses in the event the plans are divulged, and outsourcing will have positive expected value whenever $S < \frac{B}{d} + pX - C$. So long as $pX > C$,[116] the patent fallback provides an alternate means of protection against the risk of divulgence, and the firm may find it worthwhile to share its design plans with third parties as a result of its patent portfolio.[117]

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[115] Note that the patent may of course offer other enforcement benefits unconnected to backstopping information transfer. The following discussion focuses on the patent's ability to restore the exclusivity lost as a result of divulgence, putting aside other value or uses the patent may have.

[116] As will be discussed *infra* III.C, this is a consistent condition for the patent system to serve any coordination function under the model. When it does not hold, the firm will ignore the patent option and evaluate the simple risk-benefit calculus of sharing information as it did before.

[117] An ancillary way in which patents may facilitate information transfer is by reducing the risk of divulgence (d). When the undesired user of information relents in view of the

B. Scope of the Model

Although just described in terms of a particular kind of information transfer, this same theory of operation can be adapted to describe a wide range of patent-facilitated coordination. In some ways, the model is deceptively simple. Almost any potential benefit from explicit sharing or reduced precaution-taking can plug in to the B term, and almost any potential harm from that loosened grip on information can inform the d and S terms.

For example, consider a firm evaluating whether to publish a whitepaper on its latest technical accomplishments. Doing so promises a wide range of potential benefits: the chance of persuading other firms to adopt the technology, the promise of improvements made by others, easier identification of outsiders possessing complementary technologies, improvements to the firm's own reputation, and so on. All of these count in the ledger for B. But there are risks as well. Publishing this information could enable others to more easily reverse-engineer the firm's products, to take the technology in a direction that is detrimental to the firm, or otherwise compete in a way that would not be possible if the firm kept the information a secret. Together, these threaten the information's control-dependent value, S, and do so with a probability given by d.[118] Using exactly the model described above, the baseline decision of whether to publish the whitepaper turns on whether $S < \frac{B}{d}$. But again, under certain conditions, the possibility of patent-based exclusion can tip this balance in favor of publication over secrecy, such that $B > d(S - pX + C)$.

As another example, consider a firm evaluating whether to purchase a trade secret. If the transaction goes through successfully, the purchased information will have some value to the buyer that exceeds its cost. In this case, B is this net promised benefit of the transaction. But there is also a risk that the seller of the secret will continue using it or disclose it to others after the sale, an event with likelihood d that imposes a harm of S. This risk of an irremediable breach by the seller imposes some expectation of harm that can potentially prevent otherwise

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patents, this should be captured by the patent-based exclusivity term (X). But in addition to that, the patent-based deterrence of users of the information may reduce the pressure on intermediaries to spill the beans—thus reducing d. Another potential effect is that patent protection may influence the *kind* of confidential information the firm develops in the first place. *See* Risch*, Trade Secret Law, supra* note 63, at 152, 163. However, this can also be modeled as an information-protecting activity in its own right. *See* Landes & Posner, *supra* note 2, at 328.

[118] For simplicity, the model treats the risk of harm from disclosure as if it were a discrete event jeopardizing S with probability d. However, one could expand the model to include an array of potential information-related harms, replacing dS with the sum of discrete harms H_k, each with probability d_k. In that case, the no-patents version of the firm's decision is given by $B > \sum_k d_k H_k$ and the with-patents version given by $B > \sum_k d_k(H_k - pX_k + C)$. Adding this complication reduces the elegance of the α term (introduced below), but does not change its constituent inputs or any of the resulting analysis.

beneficial transactions from occurring (i.e., $S > \frac{B}{d}$). But under certain conditions, the option of a patent infringement suit as a fallback may provide the purchaser the assurances necessary to proceed with the otherwise beneficial transaction, such that $B > d(S - pX + C)$.

In this way, the model described above is a generalized form of the various ways that the coordination function may enable firms to share information more broadly, take fewer precautions, and engage in transactions around information despite the inherent risks of doing so. With the option of invoking patent protection as a fallback, a possessor of information with some control-dependent value may find it profitable to hold that information more loosely than if secrecy were her only form of protection.

C. Determining the Coordination Function's Effectiveness

This model just presented is not intended to demonstrate that the systematic benefits of using patents to facilitate coordination exceed the systematic costs, or that offering such a coordination function is even desirable.[119] Rather, it illustrates *how* the coordination function provides whatever benefits it does, assuming that those benefits are desired. And, under the theory of operation described above, it quickly becomes apparent that there are several policy levers with particular importance in determining the effectiveness of the coordination function.

As the examples in the prior section illustrate, the coordination function seeks to encourage private actors to loosen grip on some confidential information in a way that enables more disclosure and more mutually beneficial bi- and multilateral exchanges. It does this by comforting the possessor of confidential information that she will later have the ability to exclude others from using that information, reducing the control-dependent value at risk for purposes of its holder's cost-benefit calculus.

To put this in terms of the model, the coordination function reduces the control-dependent value at risk by a factor α, where $\alpha = \frac{S - pX + C}{S}$. Without any patent protection, the firm will engage in an information sharing activity (i) only if $S < \frac{B_i}{d_i}$. But once patents come into the picture, the firm will share information so long as it satisfies $\alpha S < \frac{B_i}{d_i}$. The control-dependent value at risk gets discounted by α, which allows some confidential information to make it underneath the threshold for sharing even though its value would have been too high to justify the practice in the absence of patents. The effectiveness of the patent system in serving the

[119] While a full evaluation of the costs and benefits of recognizing the coordination function is beyond the scope of this Article, this discussion nonetheless lays the groundwork for future work tackling the questions surrounding if and when the coordination might be a desirable use of the patent system. *See infra* Part V.

coordination function is thus given by $\frac{1}{\alpha}$, such that a tiny α (close to zero) results in a significant amount of patent-facilitated information sharing, and a large α (close to 1) results in a negligible amount of patent-facilitated information sharing. When α reaches 1, the patent system provides no added benefit to the secret holder, and the firm will behave as it would as if it had no patents, engaging in information sharing only if $S < \frac{B_i}{d_i}$.

From this much it is clear that a policymaker intent on increasing the effectiveness of the coordination function described by the model above should seek to minimize α. But what are the patent policy inputs that will tend to make α larger or smaller? Fortunately, a bit more refinement of this term is possible. As introduced above, the value of the exclusion (*X*) provided by the patent system is described as if it were independent of the secret's value. But these two are in fact related, given that the role of patents under the coordination function is to restore some of the exclusivity value that was previously available under secrecy. In an extreme form, a successful patent suit would completely put the genie back into the bottle, restoring the firm to the position it would have been in had the confidential information never been divulged in the first place. In that case, the value of the patent-based exclusion would be the full control-dependent value the firm started with, i.e., $X = S$. But in reality, patent remedies will almost always provide something less than that. A patent injunction may leave some room around the margin for circumvention; instead of an injunction, the court may instead award damages that are worth less than the full value of the secret; some users of the information may be beyond reach of the patent court; the confidential information may have had some expected control-dependent value beyond the length of the patent term. In these cases, the value of the exclusion provided by a successful patent suit is a fraction of the original control-dependent value. Call this fraction k, such that $k = \frac{X}{S}$. When k is 1, the patent remedy puts the patent owner in the position he would have been in had the information never been divulged. As k approaches 0, the patent remedy offers a smaller and smaller percentage of the original control-dependent value the firm possessed before disclosure occurred.[120]

Applying this relationship between the value of the patent remedy and the original control-dependent value of the information, the inputs to α are greatly simplified. Since $X = kS, \alpha = \frac{S - pkS + C}{S} = 1 - pk + \frac{C}{S}$. In other words, the effectiveness of patents for facilitating information sharing in this way depends on

[120] It is technically possible for *k* to be greater than 1—that is, for the value of exclusivity offered by the patent system (*X*) to exceed the original control-dependent value of the disclosed information (*S*). Because of the geographic and temporal limitations of patent remedies, the deck is stacked somewhat against this occurring, but with a combination of strong injunctions, enhanced damages, and attorney fee-shifting, such an outcome is possible. The following discussion assumes a firm's expected value of *k* does not normally exceed 1; the consequences of relaxing this assumption are flagged in footnotes where necessary.

just three factors: the probability a patent suit will be successful in the event the information is misappropriated (p), the proportion of the control-dependent value that can be recovered by patent remedies (k), and the cost of obtaining this patent remedy in relation to the value of the information itself ($\frac{C}{S}$).[121]

Based on the theory of the coordination function presented above, these three factors will directly determine the system's effectiveness. Generally speaking, the greater the likelihood that the patent holder will prevail in litigation, the broader the resulting patent remedies, and the lower the cost of obtaining those remedies, the more effective the patent system will be in enabling coordination. This result is intuitive: when patents provide a high likelihood of obtaining secrecy-like exclusion at low cost to the patent holder, they will induce a large amount of patent-backed information sharing, and the coordination function will be at its peak. Conversely, if the likelihood of a patent victory is low, patent remedies are weak, and patent litigation is expensive, the patent system will fail to offer much comfort in the case of inadvertent disclosure. In the extreme, the patent system may not be able to play any coordination role at all.

D. Distinctions from the Rewards Functions

To those familiar with rewards-based reasoning, the conclusion of the prior section may seem obvious: *of course* more likely, broader, and cheaper patent remedies facilitate greater coordination—for the same things would increase the effectiveness of the rewards function as well.[122] But in fact the coordination function's reliance on these elements is of another kind. And, moreover, there are a variety of other factors that are similarly important to the rewards function, but that do *not* have any direct effect on coordination. This section will highlight the ways that the operation of the coordination function described above departs from that of the traditional rewards function.

1. Strictly Necessary: Reliable, Effective, and Affordable Exclusion

While these factors are also relevant to the rewards function in the sense they influence expected value of participating in the patent system, the reliability of patent enforcement, the strength of patent remedies, and the costs of enforcing patents become essential if the patent system is to play a meaningful coordination

[121] Note however, that C isn't necessarily the full cost of litigating to judgment against every potential infringer, as settlement and out-of-court resolution may be possible, particularly after the patent has been successful asserted a few times. For example, prior empirical work has found that of all patent cases filed, approximately 80% settle before a resolution on the merits. *See* Jay P. Kesan and Gwendolyn G. Ball, *How Are Patent Cases Resolved? An Empirical Examination of the Adjudication and Settlement of Patent Disputes*, 84 WASH U. L. REV. 237, 259 (2006).

[122] *See supra* I.B.

function. In their coordination role,[123] patents are acting as a kind of insurance policy against the inadvertent or otherwise unauthorized transfer of technical information. When either the value of patent-based exclusion or the likelihood that a patent suit will be successful falls, the patent insurance policy becomes risky in its own right, and its effectiveness in backstopping voluntary transactions is reduced accordingly.

To put this in terms of the model presented above, the effectiveness of the patent system in backstopping information sharing depends on α being less than 1—the closer to zero, the more effective the coordination function. But because $\alpha = 1 - pk + \frac{C}{S}$, there are three independent conditions that can take α out of this range, compromising the patent system's ability to facilitate coordination. The coordination function can be undermined by *any one of*: 1) weak patent remedies; 2) a low probability of patent victory; or 3) high patent enforcement costs. For example, if patent remedies are not very good at restoring exclusivity value ($k \rightarrow 0$), it will not matter that patent cases may be cheap and easy to win ($\frac{C}{S} \rightarrow 0$, $p \rightarrow 1$). When the value of patent remedies pales in comparison to the control-dependent value at stake, α will approach (or exceed) 1, and the patent system won't do much to facilitate coordination. Similarly, when the probability of a patent victory is small ($p \rightarrow 0$), it may not matter that patent remedies are broad ($k \rightarrow 1$) and cheap to obtain ($\frac{C}{S} \rightarrow 0$)—α will still tend to be close to 1, and the coordination function may not be available.[124] And even if patent remedies are broad and likely to be obtained ($k \rightarrow 1, p \rightarrow 1$), the coordination function may *still* not be available if the cost of obtaining patent-based exclusion is large compared to the control-dependent value of the information at issue ($\frac{C}{S} \rightarrow 1$).[125]

Because of the relationship these variables have to the cost-benefit calculus of whether a firm will share information, each plays a critical role in determining the effectiveness of the coordination function. This is of course in sharp contrast to the rewards function, where a large number of patent policy adjustments can typically be traded off against each other, at least on some

[123] To be clear, here and in the following discussion, "coordination function" refers to the particular theory of operation just described. Other theories of operation are indeed possible, and the conclusions herein would not necessarily hold for other theories.

[124] Note, however, that *P* is the likelihood that the firm will be able to restore exclusivity any combination of the patents in its portfolio—not necessarily the probability that it will prevail in any given patent litigation. *See* Parchomovsky & Wagner, *supra* note 40, at 38-41 (discussing benefits of patent diversity).

[125] These last two observations use the conditional "may" because it is theoretically possible for generous patent remedies ($k > 1$) to offset a low probability of patent victory (p) or high cost to obtain patent remedies (C). *See supra* n. 120. Even still, there is likely a limit at which the risk aversion of patent holders prevents plush remedies from offsetting low likelihoods of victory. After all, under the coordination function, patents are operating as a kind of insurance policy against loss of control, and this function may break down when patent litigation becomes too risky.

margin.[126] Like the coordination function, the reward function also depends on the probability of patent victory, the strength of patent remedies, and enforcement costs. But a change on any one of these fronts that happens to reduce the value of the patent prize can be made up for somewhere else: a higher burden of proof on the question of infringement can be traded for longer term, more expensive patent litigation can be compensated by broader claim scope.[127] In fact, these are hardly the universe of relevant policy levers. As a rich literature suggests, the total rewards (and costs) of the patent system are influenced by application filing fees, the standards for patentability, antitrust immunities, misuse doctrine, and many other categories of patent rules.[128] All are simply tools for effecting wealth transfer to the patent holder, and one component of patentee value is—not always, but typically—substitutable for another.

In the case of the coordination function, however, such substitutability should not generally be assumed. This distinction suggests that a move from rewards to coordination justifications for the patent system should therefore be accompanied by a significant shift in the way patent rules are combined with one another to form patent policy. Rather than balancing the value proposition of the total bundle of patent rights against deadweight losses, patent policymakers would need to focus on ensuring that the bundle contains the core rights necessary to enable information transfer. With a new focus on coordination, it is no longer the case that policy changes that are neutral on patent value are necessarily neutral on the system's effectiveness.

2. No Reliance on the Initial Allocation of Patent Rights

As described above, the coordination function offers a firm an alternative means of excluding others from using confidential information in the event that information is inadvertently transferred. To serve this function, patents need to create predictable rights of sufficient scope to enable firms to reliably backstop their private arrangements around information. But, notably, nothing in the model above depends on the initial allocation of patent grants. This in turn relaxes several conditions that are necessary for a well-function rewards system.

When it comes to the rewards function, errors in the allocation of patent rights matter. The goal of the rewards function is, after all, to create private incentives to invent by transferring a thing of value to those who successfully produce a new invention. Mistakes in either direction frustrate this goal, because they weaken the relationship between the desired conduct (invention) and the promised reward (a patent).[129] For example, every time a patent is improperly

[126] *See supra* I.B.
[127] *See* Stephen Yelderman, *Improving Patent Quality with Applicant Incentives*, 28 HARV. J.L. & TECH. ___ (2014) (forthcoming).
[128] *See*, *e.g.*, Kaplow, *supra* note 1, at 1840-41; Dan Burk and Mark Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, 1642-67 (2003).
[129] *See* Abramowicz, *Patent Prizes*, *supra* note 21, at 180 (noting that a prize system requires some method of identifying worthwhile innovations and rejecting others).

denied to a rightful inventor, *ex ante* incentives to invent are reduced, since inventors face an increased risk that even if they succeed in achieving a patentable invention, they will nonetheless be denied their reward.[130] But this doesn't mean the patent office should blithely err in the direction of overgranting. A patent that is improperly *granted* also reduces incentives to invest in invention, because it introduces the possibility that an applicant will get the prize of a patent whether or not she deserves it. The reward function's incentives to invest in innovation thus depend *both* on the likelihood that a patent will be granted if an invention is achieved *and* on the likelihood that a patent will not be granted if an invention is not achieved. As a result, the rewards function implies a compelling interest not only in granting patents to those who deserve them, but in denying them to (and perhaps revoking them from) those who do not.

As the coordination function does not seek to incentivize private conduct as the quid pro quo of the patent grant, the costs of a mistaken patent allocation are not as serious. One way of looking at this is that some version of the Coase theorem is applicable in the case of coordination, but not in the case of rewards. Under the coordination view, if rights are inefficiently allocated, private negotiation is available to reach a more efficient configuration.[131] These errors aren't free of course—part of the point of the coordination function is to reduce transactions costs, not create them. But in the case of the rewards function, mistakes in allocation cannot be solved by Coasian bargaining. The very purpose of the patent grant is distributional, so it's no comfort to say that the parties can trade after the fact. As with any prize system, the success or failure of a rewards-focused patent system necessarily depend on its ability to allocate benefits to the proper parties.

To be sure, improperly granted patents may impose unjustified costs under both the coordination and the rewards view. However, for purposes of the rewards function, improperly granted patents impose additional harm by muddying the invention-prize relationship at the heart of the reward theory. This additional harm is not present in the coordination function, since its theory of operation does not depend on the accurate allocation of patents to those who deserve them. This suggests that a move from the rewards function to the coordination function should be accompanied by a reevaluation of the error costs resulting from mistakes in the patent system.

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[130] *See* Andres Sawicki, *Better Mistakes in Patent Law*, 39 FLA. ST. U. L. REV. 735, 762 (2012).

[131] *See* Mark A. Lemley, *Reconceiving Patents in the Age of Venture Capital*, 4 J. SMALL & EMERGING BUS. L. 137, 147-48 (2000) (applying Coase in this way); Guido Calabresi and A. Douglas Melamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral*, 85 HARV. L. REV. 1089, 1094-95 (1972) (discussing similar implications).

3. No Intermediate Goal of Wealth Transfer

The theory of the coordination function described above is in many ways less ambitious than the traditional rewards function. All that is necessary for the coordination function to succeed is to create reliable, private rights to exclude others from using a particular body of information. Allocating these rights to private parties may well have other effects—distributional consequences, the creation of market power, subtle pressures on industry structure, just to name a few. But these consequences are collateral, and as a result, a policymaker may find she has many more degrees of freedom implementing the coordination function as compared to the rewards function.

As the reward function seeks to directly incentivize investment in research and development by the offer a patent prize, it is inherently sensitive to the total *ex ante* value proposition offered by the patent system.[132] For example, an increase in the costs of acquiring or maintaining a patent will reduce the value of the patent package—particularly because the costs of securing a patent are certain to be incurred, and the potential benefits of successful enforcement of that patent are probabilistic.[133] Similarly, it is critical that at least *some* patents result in monopoly rents sufficient to justify the persistent costs and risks of investing in research and participating in the patent system.[134] If the total package of costs and benefits offered by the patent system do not result in some expected benefits in the case of successful invention, the patent system will fail in its goal of creating any additional incentives to invest in inventive attempts.[135]

The coordination function does not depend on any such promise of riches, which opens up a variety of policy options that would not be possible under the rewards function. For one, there is no need to distribute patents as privately valuable grants—they could be allocated by auction, for instance, allowing competitive bidding to reduce the private surplus inherent in patent issuance.[136] And even once patents are issued, their role in coordination is simply to allow firms to restore the exclusivity value of information the firm already possesses. Some changes in the scope, duration, or intensity of patent rights may not affect

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[132] *See* Abramowicz, *Patent Prizes*, *supra* note 21, at 124.
[133] *See* Yelderman, *supra* note 127, at ___.
[134] *See* Dennis D. Crouch, *The Patent Lottery: Exploiting Behavioral Economics for the Common Good*, 16 GEO. MASON L. REV. 141, 142-43 (2008); Mark A. Lemley & Mark P. McKenna, *Is Pepsi Really A Substitute for Coke? Market Definition in Antitrust and IP*, 100 Geo. L.J. 2055, ___ (2012).[135] Of course, these benefits need not flow exclusively from wealth transfer. *See* Long, *supra* note 6, at 636-37.
[135] Of course, these benefits need not flow exclusively from wealth transfer. *See* Long, *supra* note 6, at 636-37.
[136] *See* Harold Demsetz, *Why Regulate Utilities?,* 11 J.L. & ECON. 55, 63 (1968). For a thorough discussion on the costs, benefits, and feasibility of allocating patents by auction, *see* Michael Abramowicz, *The Uneasy Case for Patent Races over Auctions*, 60 STAN. L. REV. 803 (2007).

the coordination function at all, provided they leave intact this core ability to reliably restore exclusivity.[137]

From this much, it should be clear that the coordination function depends on different characteristics of the patent system than does the rewards function, and that a move from rewards to coordination goals necessitates an extensive reevaluation of patent policy. The next part will outline how these mid-level differences implicate a wide variety of policy levers throughout the patent system.

IV. IMPLICATIONS FOR PATENT POLICY

As the prior section indicated, the coordination function is not a simply an alternative justification for the patent system, another argument that happens to lead patent policymakers to the same conclusion as the rewards function. Rather, the coordination function is rooted in an entirely different theory of operation, with differing intermediate goals, and divergent mid-level principles. If one were to scrap existing patent law and build a coordination-focused regime from scratch, the resulting system would likely look dramatically different than the one we have today. But assuming any shift from rewards goals to coordination goals is likely to be gradual—and, after all, the two objectives are not mutually exclusive—it is likely more productive to consider how recognition of the coordination function would call for changes to patent policy at the margin. With that in mind, the next three sections highlight various characteristics of the system would need to be reevaluated as coordination goals take on more prominence. The final section introduces several ways that the coordination function might influence rewards-focused policymaking even if coordination goals remain secondary.

A. Reliability of Issued Patents over Accuracy of Grants

A longstanding feature of the patent system is its two-stage review process, wherein applications are first examined by the patent office and then may have their validity scrutinized a second time by courts when patentees seek to enforce them.[138] The interaction of these two review periods implicates a variety of patent policy questions: the level of scrutiny to be applied at each stage, the

[137] Another way patent rights could be significantly relaxed without necessarily undermining the coordination function would be the creation of an independent invention defense, which would allow those who develop technology wholly apart from the patentee to practice the invention notwithstanding the patent's claims. However, such a change would bring with it a complex profile of costs and benefits, and as such the viability of this proposal remains the subject of future work.

[138] In recent years, this two-period system has been complicated by the creation of multiple post-grant review processes, whereby the patent office itself may engage in further scrutiny after the patent has issued. These processes are difficult to classify, because in some ways they are a form of extended first-stage examination, and in other ways they are a substitute forum for second-stage examination. In general, however, the same balance is implicated between the accuracy of the initial grant (however that moment is defined) and the reliability of that initial grant.

deference (if any) to be applied from one stage to the other, the desirability of encouraging post-grant challenges, and so on. On one end of the spectrum, one could have a registration system, in which patents are issued by the patent office without any substantive examination, only to be reviewed *de novo* by courts should they come to litigation.[139] On the other end, one could have a system of ironclad patent grants, after which validity could be reviewed only in cases of outright fraud or bribery. Where a patent system falls between those two poles will typically depend on the frequency with which issued patents turn out to be technologically or competitively significant, the comparative cost-efficiency and competencies of the first- and second-stage decisionmakers, and the consequences of an error being made at either stage in the process.[140]

A shift from the reward function to the coordination function has particular significance for the last of these factors—the magnitude of the harms caused when the patent office makes a mistake. As discussed above, the effectiveness of the rewards function depends directly on the accuracy of the initial allocation of patent rights. The patent system's success in creating incentives to produce inventions depends on a perception (if not a reality) that patents are given to those who deserve them and denied to those who do not. When a patent is given to someone who did not in fact meet the requirements of patentability, that patent does not simply impose costs without sufficient offsetting benefits. Rather, there may be a strong systematic interest in revoking the patent as a demonstration that only truly patentable inventions will be rewarded. It should come as no surprise, then, that rewards-focused patent policy tends to prioritize revoking patent rights erroneously granted over preserving the settled expectations of patent holders.[141]

The primacy of accurate grants over stable ones under the rewards function is compounded by the fact that reliability plays no distinctive role for purposes of rewards. To be sure, patents that are frequently revoked will provide

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[139] *See* Scott Kieff, *The Case for Registering Patents and the Law and Economics of Present Patent-Obtaining Rules*, 45 B.C. L. REV. 55, 70-72 (2003) [hereinafter Kieff, *Registering Patents*].

[140] *See* Lemley, *Rational Ignorance*, *supra* note 6, at 1511-23; Kieff, *Registering Patents*, *supra* note 139, at 74-76; Sawicki, *supra* note 130, at 778-80; Mark A. Lemley and Carl Shapiro, *Probabilistic Patents*, 19 J. ECON. PERSP. 75, 84-86 (2005).[141] And indeed a number of rewards-focused cases invoke the compelling public interest in seeing validity challenges litigated to completion. *See*, *e.g.*, F.T.C. v. Actavis, 133 S.Ct. 2223, 2230-34 (2013); Caraco Pharm. Labs., Ltd v. Novo Nordisk A/S, 132 S.Ct. 1670, 1677 (2012); Asahi Glass Co., Ltd. v. Pentech Pharm., *Inc*., 289 F. Supp. 2d 986, 994 (N.D. Ill. 2003); Blonder-Tongue Laboratories, *Inc*. *v*. University *of* Illinois Foundation, 402 U.S. 313, 345 (1971); Lear v. Adkins, 395 U.S. 653, 670-71 (1969).

[141] And indeed a number of rewards-focused cases invoke the compelling public interest in seeing validity challenges litigated to completion. *See*, *e.g.*, F.T.C. v. Actavis, 133 S.Ct. 2223, 2230-34 (2013); Caraco Pharm. Labs., Ltd v. Novo Nordisk A/S, 132 S.Ct. 1670, 1677 (2012); Asahi Glass Co., Ltd. v. Pentech Pharm., *Inc*., 289 F. Supp. 2d 986, 994 (N.D. Ill. 2003); Blonder-Tongue Laboratories, *Inc*. *v*. University *of* Illinois Foundation, 402 U.S. 313, 345 (1971); Lear v. Adkins, 395 U.S. 653, 670-71 (1969).

less reward than patents that are almost never revoked. But, as with most things that affect the expected value of patent rights for purposes of rewards, this change can generally be compensated by other levers of patent policy. For example, a reduction in the likelihood that a patent will be enforceable could be offset by an increase in the value of that patent when it turns out to be a winner. To a risk-neutral patent holder, a 10% chance of a patent being valid with an enforcement value of $100M should provide the same reward as a 50% chance of a patent being valid with an enforcement value of $20M. Though changes in the risk-reward profile of filing patents may make the patent system more attractive to some participants rather than others, no particular level of certainty is necessary for the rewards function to be successful.[142] And, depending on the cost of increasing accuracy in the first stage of examination (i.e. the patent office), it might make perfect sense to regularly issue patents notwithstanding serious lingering questions about their practical enforceability.[143]

On both fronts, coordination-focused patent policy implies just the opposite. First, as discussed above, the coordination function depends only weakly on the initial allocation of rights. Improperly granted patents may impose unnecessary costs, but they are not a direct setback for the framework the system is designed to create. The costs of allowing an improperly granted patent to stand and the importance of late-stage validity review are thus significantly less pronounced under a coordination system than under a rewards system.[144] But beyond that, the coordination function depends heavily on the reliability of patent-based exclusion.[145] To return to the model described in Part III, a firm may be quite willing to share its design plans with an untrusted supplier if it is 95% certain that the firm's patent will protect it against direct copying, but unwilling to do so if it is only 45% certain. Though the exact threshold will of course depend on the benefits of the information-sharing activity and the value of the information, a consistent prediction of the model is that as patents become less reliable they will be less useful for facilitating *ex ante* coordination.[146] Therefore, the costs of revoking an issued patent—even one that was clearly granted in error—are significantly higher under a coordination-focused patent system. As a result of both of these factors, a move from rewards to coordination goals would suggest a need to rebalance patent policy to prioritize the reliability of issued patents over the correction of past mistakes.

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[142] *Cf.* Abramowicz, *Patent Prizes*, *supra* note 21, at 215-18 (observing that harms from uncertainty to a prize system are easily overstated).
[143] *Cf.* Lemley, Rational Ignorance, *supra* note 6, at 1517-18 (arguing against increased investment in examination).
[144] Note, however, that even under coordination-focused patent policy there may be a sufficiently compelling need to deter certain conduct (outright fraud or misrepresentation, for example) as to justify upsetting settled expectations in some situations.
[145] *Cf.* Heald, *Transaction Costs*, *supra* note 2, at 508.
[146] *See supra* III.C.

This reprioritization potentially implicates a wide variety of patent polices: the intensity of patent office review prior to issuance,[147] the strength of the presumption of validity after a patent has issued,[148] bounties and other incentives to challenge patents,[149] the enforceability of agreements not to bring challenges,[150] and antitrust scrutiny for reverse settlement payments,[151] just to name a few. Although each of these areas requires its own analysis, coordination-focused patent policy will as a general rule tend to prefer rules favoring early certainty over systematic accuracy, at least as compared to the traditional rewards-based approach.

B. Technological Exclusivity over Market Exclusivity

Another persistent issue at the heart of patent policy is the breadth of protection that ought to be afforded to a successful patentee. Under rewards-focused policymaking, this balancing comes down to questions about exactly how large a prize is necessary to incentivize invention, and whether larger prizes are expected to justify their larger costs. In general, the broader the claim scope, the larger the reward promised by the patent system, and the larger the costs imposed on the rest of society.[152] In the other direction, the narrower the claim scope, the lower the costs to everyone else—but smaller too are the incentives created by the patent system.[153]

This picture is complicated somewhat by the existence of many other policy levers that can alternatively influence the magnitude of the patent prize. But even putting those aside, setting claim scope to produce a right-sized reward is

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[147] *See generally* Lemley, *Rational Ignorance*, *supra* note 6; Mark A. Lemley, Doug Lichtman & Bhavan Sampat, *What to Do About Bad Patents?*, 28 REGULATION 10, 12-13 (Winter 2005-2006).

[148] *See generally* David L. Schwartz and Christopher B. Seaman, *Standards of Proof in Civil Litigation: An Experiment from Patent Law*, 26 HARV. J.L. & TECH. 429 (2013); Doug Lichtman and Mark A. Lemley, *Rethinking Patent Law's Presumption of Validity*, 60 STAN. L. REV. 45 (2007).

[149] *See generally* Joseph Scott Miller, *Building a Better Bounty: Litigation-Stage Rewards for Defeating Patents*, 19 BERKELEY TECH. L.J. 667 (2004); John R. Thomas, *Collusion and Collective Action in the Patent System: A Proposal for Patent Bounties*, 2001 U. ILL. L. REV. 305 (2001).

[150] *See generally* Rochelle Cooper Dreyfus, *Dethroning Lear: Licensee Estoppel and the Incentive to Innovate*, 72 VA. L. REV. 677 (1986); Rochelle C. Dreyfuss and Lawrence S. Pope, *Dethroning Lear? Incentives to Innovate After MedImmune*, 24 BERKELEY TECH. L.J. 971 (2009).

[151] *See generally* David W. Opderbeck, *Rational Antitrust Policy and Reverse Payment Settlements in Hatch-Waxman Patent Litigation*, 98 GEO. L.J. 1303 (2010); James F. Ponsoldt & W. Hennen Ehrenclou, *The Antitrust Legality of Pharmaceutical Patent Litigation Settlements*, 2006 U. ILL. J.L. TECH. & POL'Y. 37 (2006); Michael A. Carrier, *Unsettling Drug Patent Settlements: A Framework for Presumptive Illegality,* 108 MICH. L. REV. 37 (2009).

[152] *See* Yelderman, *supra* note 127, at ___.

[153] *Id.*

very tricky business. For the rewards function to work, the patent system must reliably award valuable patents to valuable inventions. This means claim scope must be broad enough to create market power, at least when the underlying invention turns out to be important.[154] But market power is also a driver of the major costs of the patent system—the static and dynamic losses from the patentee's exclusive use of the invention.[155] What makes this balancing more difficult than, say, selecting the size of the purse in a cash prize system, is that there will not always be a predictable relationship between the scope of technical exclusivity (the breadth as defined by the patent's claims) and the scope of market exclusivity (which will determine the patent holder's market power and hence the value of the patent prize).[156] After all, the patent office examines claims for their technical novelty, but patent value often depends on whether there turn out to be competing, marketable solutions. For example, a technically broad patent could turn out to be of little competitive significance if a handful of alternative solutions using fundamentally different technologies emerge soon thereafter. And a technically narrow patent could inadvertently dominate an entire product market if it happens to cover a critical step in a larger process. This can lead to significant divergence in individual cases between a patentee's technical accomplishment and the value of the prize awarded.[157]

These questions about the right-sizing of exclusive rights are not limited to the initial granting of claims by the patent office. They also emerge when patentees attempt to enforce their rights in technology areas far from the original invention, expand the scope of their exclusivity through acquisitions of others' portfolios or even non-patent assets, and request broader claims late in the patent lifecycle. From the perspective of the rewards theory, each raises a similar question about whether the expected benefits from increasing patent rewards through an expansion of claim scope are worth the cost, in light of available alternatives to achieve the same result.[158] In practice this is quite difficult, due in no small part to

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[154] *See* Crouch, *supra* note 134, at 142-43; Scotchmer, *supra* note 22, at 103-05; Lemley & McKenna, *supra* note 134, at ___.

[155] In IP theory generally, this balancing is often referred to as the "incentives vs. access" tradeoff. *See* Glynn S. Lunney, *Reexamining Copyright's Incentives-Access Paradigm*, 49 VAND. L. REV. 483, 556-570 (1996).

[156] For a thorough discussion of the relationship between technical exclusivity and market exclusivity, *see* Jeanne C. Fromer & Mark A. Lemley, *The Audience in Intellectual Property Infringement*, 112 MICH. L. REV. 1251, 1285-94 (2014).

[157] *See* Crouch, *supra* note 134, at 149-54; F.M. Scherer, *The Innovation Lottery: The Empirical Case for Copyright and Patents*, in EXPANDING THE BOUNDARIES OF INTELLECTUAL PROPERTY: INNOVATION POLICY FOR THE KNOWLEDGE SOCIETY 3-21 (Rochelle Cooper Dreyfuss et al. eds., 2001). Michael Abramowicz makes a similar observation (albeit from a different angle) in noting the difficulties of valuing patents for purposes of a government-funded buyout. *See* Abramowicz, *Patent Prizes*, *supra* note 21, at 155-56.

[158] *See*, *e.g.*, Kaplow, *supra* note 1, at 1867-73; *see also* Posner, ANTITRUST LAW 91-92; Bowman, *supra* note 1, at 200-203. .

the challenges of mapping technical exclusivity onto market exclusivity in a predictable way.[159]

The coordination function implies a very different set of concerns when it comes to claim scope. As described above, the coordination function depends strongly on the ability of a firm to exclude others from making use of the information that will be the subject of disclosure. If the scope of protection afforded by its patent portfolio is too narrow, it may be incapable of backstopping contractual agreements around technical information or enabling more forthcoming sharing of that information with participants in the relevant industry.[160] But this does not mean the coordination function calls for patents of unlimited scope. Once a firm's portfolio is broad enough to prevent others from using the firm's particular technology, the coordination benefits to providing any broader scope of exclusion diminish substantially.[161] Thus the coordination function would call for claim scope that provides just enough technical exclusivity to facilitate sharing of information about a firm's specific technology, but without reaching to competing solutions.

This highlights an important distinction from the rewards function: the benefits of the coordination function flow from technical exclusivity, not market exclusivity. Provided a patent (or portfolio of patents) is broad enough to prevent others from using the disclosed information, the degree to which competition is displaced at the level of the relevant product market is irrelevant to the operation of the coordination function. And, helpfully, the policy inputs that drive the success or failure of the coordination function—those that define the technical exclusivity afforded by a patent grant—also happen to be ones that the patent policymaker is well equipped to control. As compared to the rewards function, there is not the same need to indirectly modulate the degree of market exclusivity created by the patent system through manipulation of technical claim scope and the creation of antitrust immunities.[162]

A simple example illustrates how the appropriateness of claim scope would be assessed differently under either a rewards- or coordination-focused patent system. Suppose there is a pressing and widespread problem that everyone

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[159] For a similar point regarding the failure of patent scope to account for market structure, *see* Scotchmer, *supra* note 22, at 117-18.

[160] *Cf.* Burstein, *supra* note 5, at 259-60.

[161] It is possible that broader scope could facilitate disclosure and exchange of certain non-technical information: customer lists, marketing techniques, and so on. However, these are outside the scope of the coordination function, since they do not relate to the transfer of technical information. *See supra* II.B. The costs and benefits of using exclusive rights to enable disclosure of non-technical information—say customer lists—are likely quite different, and would require their own analysis.

[162] The degree of market exclusivity still matters, of course, because it will have a significant effect on the public costs of offering patent protection. The insight here is only that the *benefits* of the coordination function turn on technical exclusivity, not market exclusivity, and that this metric can be more directly influenced by policymakers.

would like to see solved. Companies A, B, and C set down different technological paths, each in pursuit of its own distinct solution. And it turns out that all three are successful: Company A files for a foundational patent on its approach, as do Companies B and C on their respective approaches. All three companies continue to work diligently to commercialize their technologies, investing in further research and preparing to ramp up production.

In a perfect world, how broad should each company's exclusive rights be in this situation? From a rewards perspective, the answer is not entirely clear. Suppose Company A was the first to produce a working solution and file its application, and so has the first bite at the patent prize. Should the patent office grant Company A claims that cover the entire product market, or just its particular solution? Should antitrust authorities allow Company A to buy Company B's patent portfolio? Should a court enforce a three-way license agreement between the competitors that sets a minimum price on any infringing products that any of the three companies sell? These questions are more difficult to answer than they might first appear. If unrestrained competition is allowed to break out among the three companies, there is a risk that prices will quickly fall to marginal cost and none of them will be able to recoup their investment in research and development. But if competition is eliminated entirely, the rewards granted by the patent system could be inappropriately large, resulting in unnecessary deadweight losses and other social harms. Though in individual cases the analysis may not be so nuanced, in principle the rewards function must confront this recurring question: whether an n-competitor patent-protected product market offers sufficient incentives to invent, or whether some additional reduction in competition should be granted or available.[163]

From a coordination perspective, the answer is straightforward: each company should be granted patent protection broad enough to enable disclosures related to its specific technology. Exclusivity that assures each firm that others will not be able to use its particular solution to the problem should be sufficient to reduce the cost of further development and increase the firm's technical transparency. Critically, the effectiveness of the coordination function does not turn on the extent of the market power created by patents. In fact, the goals of coordination can be perfectly satisfied even if Companies A, B, and C end up in brutal three-way competition in the relevant product market. And, though the question of how broad patent protection must be to facilitate sharing of information and transfer of technology may at times be a challenging one to answer, it is also a question the patent office is significantly better equipped to navigate, as it depends on the state of technology rather than the state of competition.

[163] If this framing seems foreign to those familiar with the manner in which the patent office exams claims to determine their appropriate scope, it should. This only highlights the disconnect between the intermediate goal of the rewards function (market exclusivity) and its means (technical exclusivity).

This observation is an important one, not least because it suggests that much of the debate about the desirability of the coordination function has been based on flawed assumptions. Since its inception, the coordination function has been associated with a policy prescription of issuing broad patent claims early in a technology's lifecycle.[164] Operating on this premise, commentators have been divided as to whether this feature of the coordination function is a blessing or a curse.[165] But upon reexamination, it is not yet clear whether the rewards function or the coordination function would in practice require issuing broader claims. On the one hand, it should be possible to create technical exclusivity in individual cases with scope equal to or less than the scope necessary to create market exclusivity. But, on the other hand, patentees need technical exclusivity consistently for the coordination function to work, whereas a rewards system could function with market exclusivity looming as an elusive (though not impossible to reach) outcome. On balance, therefore, it is not clear which function would typically call for broader grants by the patent office. The question is certainly not as clear as prior commentators have assumed.

Beyond the initial scope of claims granted by the patent office, another domain that would be greatly simplified by a move towards coordination goals would be the antitrust analysis applied to the merger or acquisition of competing patent portfolios. The present conundrum of the rewards function is that it asks the antitrust regulator to trade static harms (increased market power) against potential dynamic benefits (increased incentive to invent)—a balancing that is particularly difficult to perform through a series of one-off enforcement decisions. As a result, current antitrust rules relating to patent aggregation leave many fundamental questions unanswered.[166]

A move towards coordination goals would lead to a simpler principle for determining when patent portfolio aggregation is justified and when it is not. As discussed above, the coordination function depends on a firm holding a patent position that enables it to reliably exclude others from a particular technological solution. Sometimes such protection will be granted in the form of a single patent, or multiple patents issued to the same firm. In other cases, the initial patent grants will fracture the rights in a way that makes them too narrow to facilitate coordination. In this situation, coordination-focused patent policy may recognize an efficiency justification that would allow multiple patent portfolios to be combined. But, importantly, the coordination function's focus on technical

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[164] *See* Kitch, *Nature and Function*, *supra* note 2, at 267-68. Indeed, this association is so strong that it is often unclear whether "prospect theory" refers to the goal of coordinating development or this particular collection of patent policies. See *supra* n. 43.

[165] *See* Duffy, *supra* note 43, at 442-46, 499-500; McFetridge & Smith, *Patents, supra* note 43, at 198; Landes & Posner, *supra* note 2, at 319; Abramowicz, *Underdeveloped Prospects*, *supra* note 38, at 1081; Scotchmer, *supra* note 22, at 112-14.

[166] *See* Keke Feng, *Patent-Related Mergers and Market Definition Under the 2010 Horizontal Merger Guidelines: The Need to Consider Technology and Innovation Markets*, 34 T. JEFFERSON L. REV. 197, 201 (2011); Scotchmer, *supra* note 22, at 161, 177-78.

exclusivity over market exclusivity would also imply a limit to this rule. When two competing portfolios relate to different technologies, there is no added coordination benefit to be found in their aggregation, and further combinations may only serve to reduce competition. Thus the coordination view could provide a framework for distinguishing between desirable and undesirable combinations of patent portfolios, a line that existing, rewards-based doctrine often struggles to draw.

C. A Window of Patent Maturity over Precise Timing of Grants and Expiration

Another persistent set of issues in the theory and implementation of the patent system relates to time. At what point in the development of a technology should patent rights be granted? For how long should they last? What is the significance of the period between when an inventor is eligible for a patent and when that patent formally comes into force?

Under a purely prize-based (as opposed to patents-based) rewards system, the timing of those rewards is critical. If the cash purse for accomplishing some result is given too early, the system may create inappropriately large incentives to race towards that premature finish line, followed by inappropriately small incentives to actually complete the project.[167] On the other hand, if the cash purse is awarded too late in the process, the incentives to achieve the desired result are weakened, at least because of the risk that a firm may be the first to accomplish the big breakthrough, only to be snaked by a second-mover that steps in to claim the prize.[168] Thus, it is not only important that the reward be the right size and given to the right person, but that all of this happens at the appropriate point in the technology development cycle.

Addressing the need for rewards through a system of patent grants solves some, but not all, of these problems. As discussed above, one of the benefits of using exclusive rights (such as patents) in lieu of cash prizes is that they can create incentives both before *and* after the moment of grant.[169] So if patents are granted before the desired invention is truly completed, it's not the end of the world, because the owner of that patent will still have some incentive to continue development of the project—after all, doing so improves the value of her patent. This takes some of the pressure off the question of when an invention should become patent-eligible, though there are nonetheless complex issues at play in correctly balancing pre- and post-grant incentives. For example, if the patent system creates incentives to file sooner, patents will tend to expire earlier. This can be a good thing—after all, earlier expiration means new technologies are put into the public domain at an earlier point in time.[170] But in some cases, this race to

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[167] *See* Abramowicz, *Patent Prizes*, *supra* note 21, at 176-77.
[168] *See* Abramowicz, *Patent Prizes*, *supra* note 21, at 187-88 (discussing possibility of gamesmanship around timing of patent grants).
[169] *See* Kitch, *Nature and Function*, *supra* note 2, at 276-77.
[170] *See* Duffy, *supra* note 43, at 476-80.

earlier expiration can cause problems of its own. For example, if a patent expires too soon, it may leave the inventor with inadequate incentives to the complete development that the patent was intended to encourage in the first place.[171] So although a patent-based rewards system enables more flexibility around timing than a cash-based one, it is still important for a policymaker to mind the start and end dates of the exclusive rights that constitute the patent prize.[172]

A move towards coordination goals further relaxes the requirement that patent rights be granted at a precise point in a technology's development. After all, the coordination function is not intended to incentivize any specific conduct directly, so it does not imply a need to align the timing of a prize with the arc of any particular private accomplishment. Since it would be entirely consistent with the coordination function to allocate patents by auction, it's no surprise that grants could plausibly occur at the moment of initial idea, at the proof of concept stage, or on the day of the first commercial sale. Just as the core coordination function does not depend strongly on *who* gets patents, it does not depend strongly on *when* they get patents.

This is not to say timing is irrelevant for the coordination function; it just turns out that coordination is sensitive to a different set of issues. As described above, the coordination function's effectiveness comes down to a firm's ability to use its patent portfolio to reliably exclude others from using information that it would like to share with others. This implied relationship between a firm's patent portfolio and the information to be transferred leads to three timing-related concerns that will have a particularly important effect on the coordination function.

The first is the need for patent protection to remain in force so long as the information to be transferred retains its control-dependent value. If a patent is expiring in six months, it may do little to backstop the transfer of information that will have significant control-dependent value that could have been protected by secrecy for a longer time period. (In terms of the model, looming patent expiration reduces the percentage of control-dependent value that can be restored by a patent remedy, so k decreases and the effectiveness of the coordination function is reduced.) This does not mean patents late in their term are useless for coordination—only that the type of information transfer they can facilitate will change over time. For example, even a single year of patent protection may be enough to enable the exchange of information with only short-term value, or with value that could not have been very effectively maintained for very long under secrecy anyhow. Generally speaking, however, the coordination function's effectiveness will depend on patents remaining in force long enough to offer exclusion value that doesn't pale in comparison to what would have been available under secrecy.[173] If the control-dependent value that could have been maintained

[171] *See* Abramowicz, *Underdeveloped Prospects*, *supra* note 38, at 1080-81.
[172] *See* Sichelman, *supra* note 31, at 393-94; Kieff, *supra* note 31, at 710-12.
[173] This patent-based exclusion value does *not* have to equal what would have been available under secrecy (i.e., k does not have to equal 1), because the model incorporates

under secrecy dominates the exclusion value available under the patent system, k approaches zero and the coordination function ceases to be effective.[174]

The second consideration is the need for a patent portfolio to be technologically relevant to the information that will be the subject of the exchange. Even if patent terms were infinite, most patents would eventually lose their ability to backstop information exchange as industry activity moves on to new technologies that no longer infringe. This effect will vary by industry, but many patents expire functionally long before they do legally as a result of continued technological development. For example, a thick collection of patents related to VHS tapes may have had a lot of coordination value to consumer electronics manufacturers in the '80s and '90s (in the terms of the model above, $pk \rightarrow 1$), but such a portfolio likely lost much of this value as technology moved to Blu-Rays and DVDs. If technology moves on but a firm's portfolio stays the same, the likelihood of successful patent-based exclusion (p) and the value of that exclusion (k) will gradually fall, and eventually pk will go to 0. As the relationship between the firm's present activities and its patent portfolio weakens, patent-based exclusion ceases to be a realistic fallback, and the effectiveness of the coordination function is reduced.

The third timing-related consideration is the relationship between a patent's age and its reliability. As discussed above, the coordination function depends heavily on the reliability of a firm's patent portfolio. This dependence suggests that patents may need to mature a bit before they become useful for purposes of coordination. While there may be situations where early-stage applications or young patents have a high degree of reliability,[175] the typical patent application starts with a large amount of uncertainty that gradually resolves over time. In the early stages, there is often doubt as to whether a patent will issue, whether it will hold up in court, what exactly it will be able to exclude, and so on. As time goes on, more information is revealed: the patent office acts on the application, competitors introduce prior art (or don't), validity challenges are brought (or aren't), a court affirms the patent's exclusive force (or doesn't). Each round of potential review updates the probability that a patent will be able to successfully backstop voluntary disclosures of information in the future.

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other benefits (B) to the disclosure that make exchange worthwhile. The goal of the coordination function, after all, is not to incentivize disclosure for its own sake, but to enable otherwise beneficial exchanges of information to occur notwithstanding the inherent risks. *See supra* III.A.

[174] This implies there may be some information that can't be backstopped by even very young patents—that is, information with significant long-term value that can be protected by secrecy for much, much longer than the patent term, such that k is small even at the beginning of a patent's life.

[175] For example, some breakthroughs may be so substantial and likely to be publicized that an inventor can be confident that she is in fact the first to arrive at a particular solution, even before the formal steps of patent office review and district court litigation have occurred.

Though individual developments for a particular patent can obviously go in either direction, a winnowing effect causes the reliability of the patents that matter to slowly rise over time. Early on, a good number of patents fail—they're rejected, invalidated, or their scope is narrowed substantially—and hence become irrelevant for purposes of coordination. Others survive—they issue, their validity is affirmed, their scope is interpreted broadly. And these survivors begin to provide a predictable sphere of reliable exclusion around which a firm can plan what it can disclose and what it must take traditional precautions to protect. The ability of a portfolio to backstop exchanges of information will thus typically rise as its constituent patents age and mature.

These three considerations inform when a patent will be at its peak effectiveness for facilitating coordination. Often, if a patent is too young, it will not be reliable enough to backstop informational exchange ($pk \rightarrow 0$).[176] But, on the other hand, if it a patent is too *old*, it will also not be useful for backstopping exchange, either because of its limited remaining term or technical obsolescence (again, $pk \rightarrow 0$). As a result, the coordination value of any given patent likely peaks somewhere in the middle of its lifespan: after the patent has issued (and perhaps survived some degree of post-grant review), but before further technological development makes it irrelevant to ongoing industry activities. It is these patents in the middle—properly matured, but not yet obsolete—that are likely the most important constituents of a firm's portfolio for purposes of coordination. And, from a systemic perspective, the effectiveness of the coordination function depends on there being an adequate stock of appropriately aged patents in circulation for firms to acquire and rely on.[177]

Comparing these timing concerns to those of the rewards function suggests that this is another area where the long-assumed policy implications of coordination are due for reexamination. The conventional wisdom is that the coordination function requires granting patent rights earlier does the rewards function.[178] But it's not actually clear that the benefits of the coordination function turn very strongly on the timing of patent grants at all. While the timing of patent grant and expiration matters quite a bit for tailoring incentives under a reward theory, coordination is much more sensitive to the window of patent maturity—the time between when a patent becomes reliable and when it expires or becomes

[176] Even though early-stage applications may not typically have much coordination benefit themselves, they may nonetheless have substantial private value for their potential to develop into mature patents. If this is correct, one would expect to find early-stage companies investing in patents for their potential to backstop *future* transactions.

[177] Without a stable stock of useful patents, the effectiveness of the coordination function may run in fits and starts. For example, there may be some period of time when a firm's portfolio of VHS patents is obsolete and its portfolio of DVD patents is not yet mature. If that were the case, the ability of patents to facilitate information exchange would be expected to wane during the interim.

[178] As with the question of claim breadth, this assumed policy implication goes back to some of the earliest discussions of the coordination function. *See* Kitch, *Nature and Function*, *supra* note 2, at 267-68.

technologically irrelevant. Regardless of when patents are granted, if they mature too slowly, this window of usefulness will be brief, and the opportunities for patent-backed exchanged quite limited.

Of course, to a certain extent the timing of patent grants and the timing of patent maturity are intertwined; a patent owner cannot be confident in her patent's ability to exclude before she can be confident that the patent is legally hers. But the timing of grants and the timing of maturity are influenced by different policy levers. The former is primarily driven by the substantive standards of patentability: the rules for enablement, written description, and patentable subject matter foremost among them.[179] The latter is primarily driven by elements of process: the backlog at the patent office, the window for post-grant review, the deference paid to these early rounds of administrative decisionmaking. One could, hypothetically, design a patent system that puts the finish line for patentability fairly late in the development process—for example, only after a commercially viable prototype is physically presented to patent examiners—but that then moves to escalate the reliability of those rights with lightning speed—an intense one month examination window, say, followed by an irrebutable presumption of validity.

Given all of this, it is not clear whether the coordination function or the rewards function requires granting patents earlier in time. What is clear is that a move towards the coordination function reduces the relevance of the timing of when rights can be claimed and increases the relevance of the timing of when rights are reliably vested.[180] This in turn has implications for a wide arrange of details about the patent system, such as the cost and timing of post-grant review, the strength of the presumption of validity, and even the urgency of hiring additional patent examiners. In general, coordination-focused policy would call for procedures that allow patent rights to mature and stabilize quickly, as soon as the threshold of patentability has been crossed.

D. Coordination as Rewards-Focused Tiebreaker

The prior sections evaluated a variety of ways that patent policy would potentially need to change if coordination goals were to take on greater prominence in relation to rewards goals. But, as discussed above, the desirability of a patent-based coordination function is hardly a universally accepted proposition.[181] It is quite possible that the present movement towards the coordination justifications for the patent system will flounder, or that policymakers will choose to address coordination goals through other tools. This section highlights how the coordination function be used to improve the workings of an

[179] *See* Sichelman, *supra* note 31, at 355.
[180] To be clear, depending on how patents are allocated, there may nonetheless be important cost concerns in the timing of patent grants—just as there are under the rewards function. The point here is that the benefits of the coordination function appear to be much more sensitive to the timing of maturity than they are to the timing of grants.
[181] *See supra* note 5 and accompanying text.

explicitly rewards-focused patent system. After all, even if rewarding invention remains the primary goal of the patent system, there may still be benefits to recognizing the coordination function as a secondary goal to be considered when the optimal rule for purposes of the rewards function is unclear or otherwise unavailable. And, given the indefiniteness that pervades patent policymaking, such opportunities to defer to the coordination function in cases of uncertainty as may actually be quite frequent.

As described above, conventional rewards-focused policymaking begins with a presumption of fungibility to the bundle of rights that make up the patent prize. A longer term may be substituted for broader scope, a more generous damages rule can be substituted for antitrust immunities. In this view, the patent policymaker is charged with assembling patent rights that provide the desired total value to inventors at the lowest cost to society.[182] The cheapest, most-effective sticks in the bundle are added first, then the more expensive, less-effective sticks, and so on, until the total bundle creates the desired incentives to invent.

It is no secret that this is often easier said than done.[183] Moreover there are often additional considerations that complicate this simple rewards vs. deadweight loss picture. For example, will longer term really increase rewards, or will it actually turn out to reduce them by increasing competitors' incentives to invent around?[184] Even if longer term and broader scope are equivalent in terms of the rewards they provide, how do their dynamic costs compare in terms of their downstream effect on future innovation?[185] And what, by the way, is the optimal level of rewards that the patent level should provide in the first place?

In some situations, a rewards-focused policymaker may be confident enough in her answer to these questions to make a decisive choice. In others, the conventional rewards doctrine may be ambivalent or indeterminate, requiring her to look to secondary considerations as a way of breaking the tie. For example, the policymaker may consider political feasibility, the respective costs of choosing incorrectly one way or the other, and the risks and potential benefits of experimenting with a departure from the status quo. In a similar way, (and without supplanting rewards goals as the primary purpose of the patent system) the coordination function could potentially be added to the policymaking calculus in exactly such situations where rewards doctrine produces a tie.

The optimal policy for implementing the coordination function isn't always clear, but it is often revealing in situations where the rewards function is ambiguous. For example, as between an additional antitrust immunity that will be extremely valuable to patentees on a tiny number of occasions and an equally valuable but modest increase in the likelihood a court will find a claim valid, the

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[182] *See* Gilbert & Shapiro, *supra* note 34, at 106.
[183] *See* Kaplow, *supra* note 1, at 1842-45.
[184] *See* Gallini, *Patent Policy, supra* note 38, at 60; Klemperer, *supra* note 34, at 120-24.
[185] *See* Gilbert & Shapiro, *supra* note 34, at 106.

coordination function would break the tie in favor of the latter. Antitrust giveaways have (at most) an indirect effect on the coordination function, while improvements in the reliability of patents are almost always helpful. Along similar lines, a rewards-focused policymaker may be ambivalent as between increasing the cost of obtaining a patent or increasing the cost of enforcing it. Again, the coordination function provides a clear answer: as far as coordination is concerned, there is no harm to increasing the cost of acquiring a patent, but the cost of enforcement is directly determinative of the system's effectiveness. If the rewards function is truly indifferent, the policymaker is better off increasing acquisition costs rather than enforcement costs.

Recognition of the coordination function as a secondary goal of the patent system could have consequences in a wide variety of circumstances, and a full exploration of these consequences is well beyond the scope of this Article. For now, it is worth noting that the core values of reliable, cost-effective exclusion could influence selection among a wide variety policies that are otherwise equivalent for purposes of the rewards function.

V. CAVEATS AND FUTURE WORK

The prior sections have described the coordination function, presented a model of its operation, extrapolated from this model several distinctive feature of the function's operation, and noted a variety of patent policy domains that would need to be reevaluated if the coordination function were to be accepted as a legitimate goal of the patent system. This part will highlight several things this Article has *not* done—and note several avenues for future work in this area as a result.

The first thing that should be clear is that nothing in the foregoing should be construed as an endorsement of the coordination function itself. This Article accepts the coordination justification for the sake of argument to explore its underlying theory and consequences for patent policy. It does not evaluate the costs and benefits of using patents in this way, and certainly does not suggest that the normative desirability of coordination goals is a foregone conclusion.

This Article is studiously neutral on these first-order matters for a simple reason: it is impossible to have an informed debate on the question of whether to shift patent goals towards the coordination function without knowing what coordination-focused patent policy would actually entail. In some ways, the requirements described above may be a refreshing change from the well-worn issues that have so far driven rewards-focused patent policy. In other ways, a coordination-focused approach to policymaking may only exaggerate present concerns with the rewards-focused system. In either event, it is clear that the differences between a rewards-focused and coordination-focused system are real, and these may be enough to sway some deciding whether it is appropriate to use the patent system in this or the other way. There are, after all, non-patent

alternatives to both rewards and coordination problems, and it's possible that the patent system is not and cannot be well-equipped to solve the latter effectively.

With that said, an important direction for future work is a similar analysis and comparison of the expected costs and benefits of addressing the need for coordination through both patent and non-patent mechanisms. In the absence of patent protection, parties seeking to forge agreements for or around technical information are expected to rely on a combination of trade secrets, non-compete agreements, other contractual restraints, and informal or reputational arrangements. The comparative effectiveness of these mechanisms has been the subject of some study, but the comparative costs of these approaches vis-a-vis patents remain largely unexplored.

Further exploration of the costs of a coordination-focused patent system may bear additional fruit as well. For example, just as there are reward-focused policy customizations to provide the most benefit at the lowest cost, there may be refinements to coordination-focused policy that enable substantial benefits in the most common situations, while avoiding the costs of a system of proprietary rights at the moments where they are more likely to be harmful than helpful. Future work evaluating the magnitude and manner of the costs imposed by a coordination-focused patent system could inform not only these policy judgments, but also the first-order question of whether a coordination-focused patent system is desirable at all.

It is also possible that the right question to ask may be not whether or not it is desirable to use the patent system to facilitate coordination, but *how much* patent-based coordination is worth its cost. It is one thing to accept that the patent system is useful for facilitating some amount of coordination, yet another thing to determine the optimal level of patent-backed coordination. Future work will need to confront to the inevitable question of when the costs of these exclusive rights begin to exceed their benefits.

Finally, the ultimate goal of all of this line of inquiry should likely be to re-integrate the rewards and coordination functions for a unified approach to patent policy. As many of the costs of using a system of proprietary rights to incentivize invention are shared with the costs of using the same system to coordinate private development, it is quite possible that the optimal level of rewards-focused patent protection and the optimal level of coordination-focused patent protection are interdependent. In other words, there may be significant synergies available by using the patent system for both purposes simultaneously, enabling a degree of protection that would not be justified by either benefit standing alone. And, conversely, new developments undermining one justification may cause the optimal level of both kinds of protection to fall, inasmuch as each depends on the other. There thus remains much to be explored regarding the interrelationship of these two functions.

VI. CONCLUSION

This Article has defined the coordination function, set out a theory of that function's operation, and shown how a number of characteristics of the patent system would likely be different if the system were geared towards coordination over rewards. This analysis suggests that prior assumptions about the kinds of policies coordination implies have been misguided, and that as a result much of the debate about the normative desirability of using the patent system for coordination has likely been misplaced as well. There remains significantly more work to be done, both to determine the costs and benefits of using the patents in this way, and, ultimately, to re-integrate coordination-focused policy with rewards-focused policy in the context of a multipurpose patent system.