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REGULATING INNOVATION: COMPETITION POLICY AND PATENT LAW UNDER UNCERTAINTY

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UNDER UNCERTAINTY**

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INTRODUCTION

Innovation is critical to economic growth. While it is well understood that legal institutions play an important role in fostering an environment conducive to innovation and its commercialization, much less is known about the optimal design of specific institutions. Regulatory design decisions, and in particular competition policy and intellectual property regimes, can have profoundly positive or negative consequences for economic growth and welfare. However, the ratio of what is known to unknown with respect to the relationship between innovation, competition, and regulatory policy is staggeringly low. In addition to this uncertainty concerning the relationships between regulation, innovation, and economic growth, the process of innovation itself is not well understood.

The regulation of innovation and the optimal design of legal institutions in this environment of uncertainty are two of the most important policy challenges of the 21st century. The essays in this book approach this critical set of problems from an economic perspective, relying on the tools of microeconomics, quantitative analysis, and comparative institutional analysis to explore and begin to provide answers to the myriad challenges facing policymakers. Any legal regime, after all, must attempt to assess the tradeoffs associated with rules that will impact incentives to innovate, allocative efficiency, competition, and freedom of economic actors to commercialize the fruits of their innovative labors and foster economic growth.

The strength of this analysis—often described as the New Institutional Economic approach—is in its recognition that understanding economic performance requires not only economic modeling of narrow behavior, but also an understanding of that behavior in its legal, economic, social, and political

institutional context. New Institutional Economics employs the tools of economics to rigorously analyze these institutions and relationships (Joskow, 2007). In the context of innovation, the New Institutional Economics approach requires rigorous thought about questions of institutional design and its potential impact on technological change. As Joskow (2007) notes, technological change has always been understood as an important component of economic growth, but

the theoretical and empirical foundation for understanding the rate and direction of innovation and how they are influenced by microeconomic, macroeconomic, institutional and policy considerations was poorly understood. Economic growth was driven by changes in capital and labor inputs, exogenous technological change, and poorly understood differences between countries over time and space.

In the tradition of Coase, North, Williamson, Klein, Alchian, Demsetz, and other key contributors to the development of the New Institutional Economic approach, the papers in this volume apply economic insights to the challenging questions associated with regulating innovation, contributing to the policy debate a more rigorous theoretical and empirical understanding of how particular legal institutions are likely to impact innovation and growth. Application of this robust framework to the economics of innovation suggests several fruitful paths for scholarly inquiry explored throughout the book, including at least the economics of innovation, the relationship between innovation and competition policy, the patent system itself, the nature of property rights and theoretical perspectives on patent law, and the appropriate antitrust regulation of standard setting organizations. However, each of these issues is related to the much broader and unifying theme of regulating competition in a dynamic and innovative market setting.

We have entitled our book *“Regulating Innovation: Competition Policy and Patent Law Under Uncertainty”* because we believe any coherent regulatory framework must take account of the low level of empirical knowledge surrounding the complex relationship between regulation – both through competition policy and patent law – and innovation, and the corresponding uncertainty caused by this absence of knowledge. The relationship between regulation and innovation has posed a significant challenge to antitrust economists at least since Joseph Schumpeter’s (1942) suggestion that dynamic competition would result in “creative destruction,” leading to a competitive process where one monopolist would replace another sequentially as new entrants developed a superior product.

Schumpeter’s argument is often relied upon in support of the proposition that antitrust enforcers should be reluctant to intervene in product markets because short run welfare gains are likely to be swamped by a reduction in dynamic efficiencies associated with less innovation. Of course, the Schumpeterian argument can be pushed too far. It need not be the case that all welfare tradeoffs between static product market competition and dynamic efficiencies everywhere tilt in favor of the latter. Similarly, the central, elusive issue at the heart of the patent system is the tradeoff between the ex ante incentive to create and the ex post, dynamic consequences of patent policy that may impede sequential innovation in order to incentivize a priori creation (Scotchmer, 2004). Unsettled is the question of the magnitude of this tradeoff and the long-run economic consequences of specific elements of the patent system aimed at promoting development on either side of this tradeoff.

In the domain of competition, the well-known and oft-discussed tensions between monopoly, innovation, and product market competition have generated

a substantial body of literature concerning the appropriate role of antitrust enforcement in the regulation of innovation (Baker 2007, Gilbert 2007, Evans and Hylton 2008). This debate has prompted numerous proposals from commentators seeking to identify the most desirable approach to incorporating innovation into antitrust analysis, including the development of the “innovation market” concept (Gilbert 1995) or a more precise and rigorous approach to accounting for the likely costs and benefits of innovation in merger analysis (Katz and Shelanski 2007). Federal agency officials, particularly at the Department of Justice, have also recently demonstrated a concern for antitrust policy that overreaches by attempting to increase short run product market competition at the expense of dynamic efficiencies created by innovation (See, e.g., Barnett 2006, Masoudi 2006).

Taken collectively, the above are a welcome departure from a regime that myopically presumed a static market analysis would generate desirable outcomes, especially when that analysis is undertaken without sufficient sensitivity to the institutional settings in which enforcement occurs costlessly and omniscient enforcers act on the basis of perfect economic models and full information. Until Easterbrook (1984)’s seminal insights about the relationship between the social costs of erroneous antitrust enforcement and optimal liability rules, the long-term economic consequences of imperfect intervention (or non-intervention, for that matter) had been an oft-ignored but fundamental aspect of proper competition policy. The more recent recognition of the importance and difficulty of dynamic economic analysis is part and parcel of this trend. Both reflect the influence of New Institutional Economics.

These ongoing policy discussions are even more acute in the debate over whether reform of the antitrust laws is required to make them coherent in a “new

economy” in which innovation, intellectual property, and technological change are essential components of the competitive process (Posner, 2001). The emerging consensus appears to be that economic analysis and learning are a sufficient basis to conclude that antitrust *should* incorporate dynamic efficiencies into the current framework by accounting for the impact of competition to engage in research and development for new or improved goods, services, or processes. For example, the Antitrust Modernization Committee Report and Recommendations (2007) optimally declares:

[C]urrent antitrust analysis has a sufficient grounding in economics and is sufficiently flexible to reach appropriate conclusions in matters involving industries in which innovation, intellectual property, and technological change are central features.

Slowly, the center of the policy debate appears to have shifted from whether regulatory efforts should account for the relationships between competition, property rights, innovation, and economic welfare to how regulators should incorporate theoretical and empirical knowledge of these relationships into sensible policy. These developments have the potential to improve antitrust analysis and benefit consumers. Regulatory regimes ignoring dynamic competition and efficiencies are as unlikely to improve welfare as those which are so paralyzed by fear of deterring innovation that they fail to make appropriate interventions in product markets where consumers are threatened by anticompetitive conduct.

In patent policy the debate is no less acute, although appreciation for the limits of both our knowledge and our regulatory institutions is perhaps better developed. There is a strong, recent push in the courts, in the commentary, and in Congress to limit the extent of the property rights protected by patents. In the courts, a string of recent decisions culminating in the Federal Circuit’s 2008 *Bilski*

decision (currently awaiting a hearing in the Supreme Court at this writing) has weakened the scope and strength of patent protection, particularly for the sorts of algorithmic innovations at the heart of the “new economy.” Commentators have similarly mounted a scathing campaign against the present U.S. patent system. While some of this has been essentially ideological, “anti-property” rhetoric (Stallman, 2002), more recent economic analysis has been built on far stronger foundations (Bessen and Meurer, 2008). Along the same lines, the push for patent reform in Congress has reached a frenzied pitch, with passage of some sort of legislation almost inevitable in the coming years.

Much of the economic literature on the patent system is inherently built on an institutional foundation where elements of the patent granting and enforcement systems are subjected to close scrutiny. Nevertheless, there remains a dearth of rigorous economic literature seriously addressing the role of property rights and institutions in facilitating competition, innovation, and economic growth. There is no doubt that more work remains to be done to rigorously incorporate the potential impact of antitrust and patent law on innovation and dynamic efficiency. The fundamental challenge is identifying a sound analytical framework to guide policymakers, courts, and agencies in designing policies that achieve the desired goals of encouraging innovation and growth while satisfying the constraint that social gains outweigh the sum of administrative and error costs.

Meeting the demands of this challenge is easier said than done. Our economic knowledge regarding innovation itself, conduct affecting innovation, and how to assess competitive outcomes involving tradeoffs between product market competition and innovation is far less impressive than our knowledge in a purely static setting. The error cost approach to antitrust policy (Easterbrook

1984) teaches that regulators' decision-making process must be informed by the relatively high costs of false positives that lead to a chilling of procompetitive innovation. The error cost framework has been applied fruitfully to resolve debates over the optimal antitrust liability rules for predatory pricing, bundling, tying and other contractual practices (Evans and Padilla 2005, Beckner III & Salop 1999, Hylton and Salinger 2001, Froeb et al., 2005). Over the past several decades, industrial organization economists have collected a small but ever-growing body of empirical evidence concerning the likely competitive effects of various business practices that have attracted antitrust scrutiny, such as vertical contractual restraints (see Cooper et al., 2005). This empirical evidence informs our perceptions of the likelihood that any given practice is procompetitive and the expected frequency of false positives. Where the conduct at issue involves innovation, the key to economic growth, the social costs associated with false positives are no doubt high. It is therefore critical to assess the state of our economic learning related to antitrust analysis of competitive effects in markets where innovation is an important component of the competitive process. A key policy question is whether existing economic theory and empirical knowledge provide a sufficient basis for identifying those instances innovation or conduct impacting innovation will reduce welfare and produce social gains that outweigh administrative and error costs.

While the emerging consensus appears to answer this question in the affirmative, the incorporation of innovation considerations into competition policy and patent law is a more difficult enterprise than has generally been appreciated. Many scholars have recognized that our empirical knowledge of the relationship between market structure and innovation, as well between market structure and consumer welfare, is limited relative to our understanding

of static price effects in conventional product markets. The limits of our empirical knowledge are just one important constraint on the ability of regulators to confidently intervene in markets on behalf of consumers.

A second important source of complexity facing regulators is the multi-dimensional nature of competition. “Competition” involves a remarkably heterogeneous set of activities. The competitive process requires various forms of rivalry that occur on multiple dimensions: output, price, quality, and innovation. The key point for would-be regulators, highlighted by Demsetz (1990) among others, is that these forms of competitive rivalry are frequently inversely correlated. The critical point is that the relevant question for competition policy authorities is whether they have a reliable basis upon which to determine which mixture of competitive activities, including innovation, will maximize welfare.

The Demsetzian view was that the multiplicity of competitive activities undermined, perhaps completely, the ability of “scholars, lawyers, judges, and politicians” to confidently “agree that a policy has increased (or decreased) the general level of competitive intensity.” Even when there was consensus that a particular rule change or change in the mix of competitive activities was for the better, Demsetz argued that the consensus was likely the product of “our heavy reliance on perfect competition, monopoly, and oligopoly models, all of which focus only on imitative output competition.” While today’s competition and innovation policy communities may not publicly express Demsetz’s skepticism concerning the promise of antitrust rules in improving the mix of competitive activities, the spirit of the underlying skepticism illustrates the heart of the question motivating a significant portion of modern competition policy debates: is the economic or empirical basis of rules and proposed policies providing

incentives to alter the mix of competitive activities sufficient to justify confidence that the policy changes will do more good than harm?

Where these forms of competitive rivalry are negatively correlated, such as static price competition and innovation, evaluating the benefits of these alternative bundles in terms of consumer welfare requires knowing the marginal rates of technical substitution between competitive forms in order to convert different forms into common units of consumer welfare. What empirical evidence do we have about these rates of substitution? Others (Gilbert 2007, Baker 2007) have documented this extensive literature in greater detail than is required for our purposes, but we briefly survey the existing theoretical and empirical knowledge of the relationship between product market competition, consumer welfare, innovation, and market structure.

It is useful to begin with an understanding of some well established economic principles of the relationship between competition and innovation that have emerged from this literature (Gilbert 2007b). The first principle is that competitive rivalry associated with innovation is a form of competition itself. In other words, competition encourages innovation by providing an incentive for each competitor to win the “prize” associated with appropriating the gains from the innovation. The second principle is that product market competition encourages competitors to innovate to face less competition and earn greater profits. The converse can also hold: a firm that does not face substantial product market competition might have less incentive to innovate. This effect is at the heart of John Hicks’s (1955) observation that the “best of all monopoly profits is a quiet life,” and has been referred to as the “escape-the-competition” effect. The third principle is related to the second and posits that firms that face greater product market competition post-innovation will have less incentive to engage in

research and development. The fourth principle is often referred to as the “preemption effect,” which illustrates that a firm may have an additional marginal incentive to innovate if the innovation will discourage rivals and potential entrants from investing in research and development themselves.

By themselves, these non-mutually exclusive and sometimes conflicting economic principles do not tell us what role competition policy and patent law should play in innovative industries. For example, the maxim that innovation is a form of competition offers little guidance for antitrust policy. All agree that innovative activity is an essential part of the competitive process. The *antitrust-relevant* questions, however, are not whether competition that spurs innovation and consumer benefits should be encouraged or whether attempts to reduce such competition should violate the antitrust laws. Rather, the antitrust-relevant policy question is whether antitrust agencies and judges can confidently predict when antitrust policy might increase or decrease innovative activity in a way that makes consumers better off. If firms are engaging in an endogenously determined mixture of competitive activities and an antitrust policy designed to encourage innovation is successfully introduced, we can expect the new mixture of competitive forms to involve more innovation and less of other forms of competition. But it is unclear that the first principle tells us anything more about the likely consumer welfare effects of the policy. The key policy challenge is to identify the conditions under which antitrust agencies and courts can a sufficient economic and empirical basis to believe that a specific intervention is going to improve welfare.

The same logic applies, of course, to patent law reform. Competition might be encouraged by the strengthening of property rights, with firms competing for a more-substantial reward; or it might be deterred, where strong

rights and inefficient institutions impede future competition and innovation or induce inefficient rent-seeking. Again, regardless, the first principle does little to enable any informed or rigorous analysis of specific policy proposals. The second and third principles do not offer better policy guidance on their own. Leaving aside the methodological issue of how one measures competition in these models, these principles teach that product market competition might increase or decrease the incentive to innovate under different conditions. Finally, the fourth principle, the “preemption effect,” teaches that dominant firms might have a greater incentive to innovate in order to reduce the innovation incentives of rivals and potential entrants. The “preemption effect” applies not only to “sham” innovations, but innovations that offer consumers immediate and tangible benefits such as offering a new product or increasing product quality.

The current state of the theoretical literature relating to competition and innovation is alone insufficient to instill any great confidence in our – or regulators’ – ability to determine what antitrust policies will encourage innovation and result in net consumer welfare gains. Specifically, our ability to apply antitrust standards depends on our ability to predict how a rule will impact the *mixture* of competitive forms that will exist after the policy is implemented and to rank these mixtures on consumer welfare or efficiency criteria. At this point, economic theory does not appear to provide a reliable method of making such a determination. Gilbert (2007) notes that “economic theory supports neither the view that market power generally threatens innovation by lowering the return to innovative efforts nor the Schumpeterian view that concentrated markets generally promote innovation.”

There are several reasons for this uncertainty. First, as discussed above, our theoretical knowledge cannot yet confidently predict the direction of the

impact of additional product market competition on innovation, much less the magnitude. Additionally, the multi-dimensional nature of competition implies that the magnitude of these impacts will be important as innovation and other forms of competition will frequently be inversely correlated as they relate to consumer welfare. Thus, weighing the magnitudes of opposing effects will be essential to most policy decisions relating to innovation. Again, at this stage, economic theory does not provide a reliable basis for predicting the conditions under which welfare gains associated with greater product market competition resulting from some regulatory intervention will outweigh losses associated with reduced innovation.

But regulators, policymakers, and judges need not rely only on this theoretical literature alone to guide policy. Rather, one expects policymakers to turn to our empirical knowledge of the relationship between competition, innovation, and consumer welfare. There are at least three empirical relationships that are relevant to policymaking in this area. The first is the relationship between product market competition and innovative activity; the second is the link between firm size and research and development; and the third is the connection between patent activity and innovation or economic growth.

Unfortunately, here, too, we believe that the available evidence, given the current state of the empirical literature, is an insufficient basis upon which to ground policy decisions. Early studies of the link between product market competition and innovation supported the Schumpeterian hypothesis by finding an inverted-U relationship: innovative activity is at its maximum at intermediate levels of market concentration and decreases as concentration approaches monopoly or more atomistic structures (see Baker 2006, Katz and Shelanski 2007, Gilbert 2007). But the failure of these early studies to account for differences

between industries, and the endogeneity in the relationship between market structure and innovation, undermines their value. A recent study by Philippe Aghion, et al. (2005) suggests that the link between market structure and markups of price over average costs might indeed have an inverted-U shape, though commentators have noted that the study does not provide a basis for policy decisions regarding the role of innovation in well defined markets because the analysis only controls for industry effects at the two-digit SIC code level. Other studies (Hylton and Deng, 2006) have examined the impact of changes in market structure within a single industry over time to analyze the relationship between product market competition and productivity or innovation with mixed results. And others (Hylton and Deng, 2006) have examined whether competition policy enforcement is associated with greater competition or productivity, again, with mixed results.

Another strand of empirical literature examines the relationship between firm size and research and development. Gilbert (2007) summarizes the findings in this literature as consistent with the theory that the effects of firm size and competition on innovation should be greater for process than product innovations. Gilbert's careful examination of the empirical record concludes that the existing body of theoretical and empirical literature on the relationship between competition and innovation "fails to provide general support for the Schumpeterian hypothesis that monopoly promotes either investment in research and development or the output of innovation" and that "the theoretical and empirical evidence also does not support a strong conclusion that competition is uniformly a stimulus to innovation."

Finally, another expansive vein of literature has explored the relationship between patent activity and innovation or other determinants of economic

growth (e.g. Maskus, 2000). Perhaps the most compelling of these studies is (Moser, 2005). Again the conclusions and policy implications that can be drawn from this literature are unclear. Measuring complex relationships and controlling for confounding variables are significant problems, and little of the “evidence” supporting the role of patents in promoting economic growth in a given patent system is very strong. This means, however, that claims regarding the costs or benefits of tweaking marginal aspects of the patent system are also weak. In sum, the theoretical and empirical literature reveals an undeniably complex interaction between product market competition, patent rules, innovation, and consumer welfare. While these complexities are well understood, in our view, their implications for the debate about the appropriate scale and form of regulation of innovation are not.

The implication of this uncertainty is not necessarily that economically coherent regulation of innovation is hopeless, however. To the contrary, economists are developing tools to generate more precise and reliable understandings of these relationships. There are indeed some well-supported institutional, political and microeconomic relationships that can and do inform our thinking about shaping these regulatory institutions—we are not completely powerless or ignorant, but nor can we be secure in our judgments. In the meantime, scholars and regulators in the fields of competition policy and patent law must do their best to grapple with uncertainty, problems of operationalizing useful theory, and, perhaps most important, the social losses associated with error costs. It is our hope that the papers compiled in this volume will begin a fruitful inquiry into how to design legal institutions that are mindful of the complexities of the relationships between regulation, innovation, and welfare.

The Papers

The first two papers in this volume, presented as keynote addresses at the first two George Mason Law School/Microsoft conferences, present some important institutional background for understanding the narrower papers that follow. In the first, Robert Cooter sets out to describe some of the problems of targeting industrial policy to achieve economic growth—arguably the ultimate goal of the regulation of innovation—in states with poorly-defined markets and laws. The basic intuition is that sustained growth occurs in developing nations through improvements in markets and organizations, rather than through laws aimed at protecting or challenging specific business practices. Entrepreneurial innovation resembles biological mutation in that it is unpredictable before it occurs and understandable afterwards. It is unpredictable because it begins with an innovator who acquires private information and earns extraordinary profits. It is understandable because it ends with the public figuring out the innovation and subsequent investors earning ordinary profits. According to Cooter, these characteristics of innovation have important consequences for law and policy to foster economic growth. Government officials who rely on public information cannot predict which firms or industries will experience rapid growth. Consequently, industrial policies that promote growth are unlikely to succeed. In contrast, secure property and contract rights and effective business law (especially the laws regulating financial markets) create conditions under which competition naturally produces entrepreneurial innovation and nations become rich. The main obstacle to sustained economic growth in poor countries today is ineffective civil and business law.

The implications of these insights are quite important. First, Cooter highlights the information problems that plague even well-meaning regulations

aimed directly at encouraging growth—a problem perhaps magnified in developing nations but one that is not ameliorated in economically-successful ones. Second, Cooter’s normative claim—that governments can and should provide background commercial and civil laws that allow innovation to occur—suggests that there is a role for law and regulation in encouraging growth. This claim nevertheless requires us to take seriously institutional limitations in identifying where and how to use the law to do so.

Richard Epstein’s paper develops further the case against targeted regulatory efforts to stimulate innovation in intellectual property. In particular, Epstein develops a framework for understanding basic property rights and property laws to help to explain how the basic rules governing the assignment and alienation of property rights work to facilitate innovation and growth. He uses this framework to critique modern IP cases that impose limits on the terms of private licenses and that restrict the property-rights scope of intellectual property in the name of encouraging innovation. Epstein’s conclusion, like Cooter and Schaefer’s, is that the underpinnings of innovation are to be found in the basic rules of law, not targeted at correcting a perceived imperfection but rather aimed at ensuring ample space for entrepreneurship, innovation, and contracting activity which spurs economic growth.

These papers lay the groundwork for the papers that follow, all of which lend some support to the institutionalist view espoused in these keynotes. The essence of the papers is found in the notion that economics, and in particular a clear understanding of the economics of institutions, can inform our understanding of the optimality of regulation in this complex arena. Although we do not have a clear answer to the question what regulations best promote

innovation in an economy, we do have the rudiments of a better understanding of the question.

The Economics of Innovation

The first set of papers considers the *processes* of innovation and attempts to assess the extent to which management of the process may be successful and necessary, or misguided. The first paper, by Stan Liebowitz and Steve Margolis, considers the prevalence of bundling in product innovation. Liebowitz and Margolis note that in a number of distinct product markets, regulators have acted against bundling of product features or services, but it is not clear that the regulators understand the role of bundling in these technologies. A clearer understanding of the process leads to important policy implications. Among others, for example, there has been regulatory opposition to patent pools, cable television programming, software products, hardware-software combinations, and telephone service. But Liebowitz and Margolis note that these arrangements often appear to be attractive ways of marketing information goods. In many of these cases, bundling solves a pricing problem regarding non-rival goods; in others it offers production or service cost advantages. As Liebowitz and Margolis note, political or legal opposition to bundling often originates with competitors who wish to sell individual components of a bundle, or from consumers who wish to buy one component of a bundle, usually at some a pro-rata price. It is difficult, however, to discover legitimate anticompetitive instances of bundling. The paper considers why bundling arrangements arise in the marketplace, particularly in the context of new technological innovations. The paper then uses this framework to assess some of the claims that are used to support regulations imposing unbundling, and finds them wanting. Without knowing (because we can't) in specific circumstances whether bundling might be

anticompetitive, Liebowitz and Margolis give us strong insight into the general justifications and prevalence of bundling-which in turn helps to reshape our assessment of the desirability of regulatory “solutions.”

Like bundling, networks are a pervasive feature of many modern technological innovations, and platform development has proved to be a machine of economic growth. Nevertheless, many economists and legal scholars argue that the presence of network effects creates a form of market failure known as “network externalities” and “lock-in.” Based on this alleged market failure, advocates recommend new forms of antitrust and regulation targeted at particular firms in the communications and information technology industries, especially. The debate over network effects has had major consequences for these industries, with effects comparable to landmark antitrust cases involving IBM, AT&T, and Microsoft. Dan Spulber’s article builds on both his own earlier work as well as Liebowitz and Margolis to demonstrate that many supposedly-deleterious aspects of technology lock-in and network effects applied in antitrust discussions are based on an incorrect economic analysis. The article begins with a comprehensive examination of the nature of technology “lock-in” and its relationship to network effects. Following on the technological analysis, the article considers whether market institutions are capable of adjusting to address network effects or whether market failure leads to “network externalities.” The article finds and details three powerful mechanisms that exist to mitigate the presumed extent of network externalities, and these essential processes are, in fact, an important part of the value of networks. The article then proceeds to examine how network effects arguments call forth various types of antitrust policy. In the end, Spulber’s article presents some fundamental but novel thinking about the intentional structure of networks and shows that while

network effects are an important economic phenomenon, market institutions are fully capable of addressing their problematic consequences. Technology lock-in does not constitute a major market failure, and antitrust policy based on ameliorating it is likely to have adverse impacts on both competition and innovation.

The final paper in this section, by Marco Iansiti and Greg Richards, examines the innovation lifecycle and its implications for competition and public policy. Again the focus is on the dynamics of certain market structures and the process of innovation. Here, Iansiti and Richards illustrate the workings of technological “assimilation”: how technological innovations that were once marketed as individual products become integrated into broader platforms, which in turn provide the building blocks of further innovation. Here both bundling and networks come into play, with different stages of platform development displaying different characteristics of bundles and networks. Relying on the findings of recent patent citation studies, the paper finds that certain “core” innovations serve as a broad foundation for future generations of innovative products, shaping the evolution of sometimes-vast ecosystems of beneficiaries. The implications are important for regulatory policy, which does not generally take into account product lifecycle and the development (or disintegration) of bundles and networks, but rather neglects these more dynamic characteristics of much new technology. As the authors suggest, any regulatory intervention at a single point in time may not fully account for the follow-on development that may justify narrow restrictions of competition in the short run.

In sum, the papers in this section consider that the form of innovation—whether through bundling, networks, or assimilation—has important implications for the propriety of the regulatory response. Here the authors have

presented simple (as in the opposite of complex; not the opposite of difficult) explanations for the processes of innovation, shedding important light on the relevance of these processes for the innovations themselves. In turn, these analyses illuminate the (in)applicability of regulations that insufficiently consider the underlying dynamics of the innovation process.

Innovation and Competition Policy

The next section deals directly with the application of antitrust rules to organizations, with particular attention to the role of innovation in assessing the proper role for antitrust. These papers again build on the previous papers, highlighting the problems of ensuring that competition policy promotes innovation given the informational and dynamic problems of complex and innovative markets.

The first paper, from David Teece and Greg Sidak, carries over the discussion from the previous section, highlighting the problem of optimal regulatory policies in a world where innovation occurs in markets with rapid technological change, including through platform development, bundling and product life cycle development. Building on the core insight that the benefits of economic activity should be weighed over a broader range than is customary both in time and space, the paper asks how competition policy should be shaped if it were to favor Schumpeterian (dynamic) competition over neoclassical (static) competition. Schumpeterian competition is the kind of competition that is engendered by product and process innovation—the sort encompassed in particular in Iansiti and Richards’ concept of assimilation. According to Teece and Sidak, such competition not only brings price competition—it tends to overturn the existing order. A framework that favors dynamic over static

competition would put less weight on market share and concentration in the assessment of market power and more weight on assessing potential competition and enterprise level capabilities. By embedding recent developments in evolutionary economics and the behavioral theory of the firm into antitrust analysis, the article begins to develop a more robust framework for antitrust economics. As other papers in this volume discuss, this framework is likely to lead to less confidence in the standard methodologies of antitrust economics when the business environment is associated with rapid technological change.

Joshua Wright's paper also highlights the complexities of markets and the constrained ability of targeted regulations to maximize innovation. Harold Demsetz once claimed that "economics has no antitrust relevant theory of competition." Demsetz offered this provocative statement as an introduction to an economic concept with critical implications for the antitrust enterprise: the multi-dimensional nature of competition. Competition does not take place upon a single margin, such as price competition, but several dimensions that are often inversely correlated: a liability rule that deters one form of competition will often result in more of another. This insight has important implications for the current policy debate concerning how to design antitrust liability standards for conduct involving both static product market competition and dynamic innovative activity. Wright's paper revisits Demsetz's broader challenge to antitrust regulation in the context of the frequently discussed tradeoffs between innovation and price competition. The paper summarizes recent developments in our knowledge of the relationship between competition and innovation, highlighting the sorts of deficiencies described in previous papers in this volume—deficiencies that significantly constrain antitrust enforcers' abilities to confidently calculate inevitable welfare tradeoffs. Highlighting the fact neither

economic theory nor empirical evidence provides guidelines which allow enforcers to accurately identify conduct in markets where innovation is an important dimension of competition, Wright argues that antitrust enforcement should be held to a high standard of proof and evidence in order to minimize the significant social costs associated with false positives in this context.

Keith Hylton and Haizhen Lin's paper turns specifically to the problem most implicated in the application of antitrust law to innovative industries: monopolization law. In particular, Hylton and Lin compare American and European monopolization law to begin to identify and measure the extent to which monopolization law as applied contributes to or detracts from economic growth. As Hylton notes, American courts have taken a relatively conservative approach toward monopolization law inasmuch as that courts have shown reluctance to penalize a monopolist absent proof of anticompetitive conduct and that they have, at least at the doctrinal level, permitted a wide consideration of "efficiency defenses." Europe, in comparison, has taken an interventionist approach. Given the problems of information and a dynamic economy, the authors conclude that error-cost analysis provides a justification for the American approach.

Taken together, these papers present a coherent argument for humility in the application of antitrust laws, particularly in environments characterized by significant innovation and change. The institutional limitations of those called upon to enforce antitrust laws, the complex processes of innovative markets, and the probability as well as the cost of Type II error leads these authors to counsel caution.

The Patent System

The next set of papers applies a similar critical analysis to the operation of national patent systems—the other pillar of regulation most relevant to the operation of innovative markets. Again, the central problem of uncertainty and the error costs of overly-restrictive limits on rewards to innovation are the central themes animating the conclusions in these papers.

The first paper, by Vincenzo Denicolò and Luigi Franzoni, asks what rights should be assigned to a party that has discovered a new idea or a new technology given the dynamic process of innovation and the inherent limitations in granting long term rights in the absence of information about the future. Should the first innovator be able to exclude potential rivals or should property rights be mitigated so as to allow for some degree of imitation and competition? Denicolò and Franzoni address some basic issues pertaining to the optimal nature of the exclusion rights of successful innovators with respect to parties that might arrive at the discovery at a later time. Further, the authors develop a test for the patentability of innovations able to capture the difficult trade-off between the goals of fostering innovation and promoting its diffusion.

Denicolò and Franzoni argue that *fully exclusive rights* represent the efficient way of rewarding innovation when competition in the product market is weak, the innovation is "big", and research entails little spillovers. The paper's essential insight is that incentives to invest in research (particularly where spillovers from others' research are small) and thus to make important innovations are dependent on the size of the ex post reward. As a result, even where granting a relatively expansive right might seem to restrict further exploitation of an innovation (an assumption not necessarily warranted, although not discussed in the paper), the authors suggest it may still be efficient in order to induce efficient investment in innovation. This insight suggests,

among other things, that an independent inventor defense may be quite counterproductive in some environments, that closed industry standards may be preferable to open ones, and that patent breadth should perhaps be large. Moreover, the authors suggest that the application of antitrust laws to claimed exclusionary behavior involving patents is likely undesirable—again because of the risk of under-incentivizing innovation research expenditures.

Next, Mark Lemley and Doug Lichtman apply a close institutional analysis of the US Patent and Trademark Office to assess the scope and cost of a particular (and important) type of error, deriving implications for patent reform from their findings. As the authors note, the USPTO is tasked with Herculean job of reading and assessing all patent applications, pursued subject to enormous informational and budgetary constraints. Nonetheless, under current law, courts are largely bound to defer to the Patent Office’s decisions regarding patent validity. As the authors point out, such deference to previous decision-makers is appropriate in instances where those previous decisions have a high likelihood of accuracy, and the patent system should endeavor to create processes that fit this mold. Granting significant deference to the *initial* process of patent review, however, is indefensible and counter-productive. The informational constraints inherent in the system should render patents vulnerable to challenge until and unless they are significantly evaluated in an information-rich environment. The effect of facilitating such challenges—challenges impaired by the law’s automatic presumption of patent validity—would be to give patent applicants better incentives to file for genuine inventions but leave their more obvious and incremental accomplishments outside the patent system’s purview. Counterintuitively, Lemley and Lichtman find that the costs of gathering and assessing information counsel for weaker, rather than stronger, property rights in

patents. Nevertheless, the approach reaffirms the analytical framework that precedes—information and institutional capacity limitations are important elements in assessing the error costs of particular regulatory approaches.

Michael Meurer echoes this assessment in his paper, focusing on the exacerbation of information problems caused by the “fuzziness” of patent boundaries. Meurer’s paper surveys the mechanism design approach to patent design (best illustrated by the work of Scotchmer (2004)) and comments on whether the key results are robust to inclusion of fuzzy patent boundaries in the models, and what sort of future research is needed to incorporate a serious treatment of patent notice failure into models of patent design. According to Meurer, a failing of the current patent system is that the grand bargain—exclusive rights in exchange for full disclosure enabling subsequent innovation—may not be functioning effectively in some subject areas.

Property rights and the theory of patent law

The papers in this section take up the question of the role of the institution of property set out by Epstein in his paper with particular reference to the patent system. These papers are concerned with the broader, more philosophical question of the importance of property rights in encouraging and facilitating innovation—and thus they also take up the mantle of Cooter and Schaefer’s paper by illuminating the importance of well-defined background rules and the concepts that imbue them.

Adam Mossoff’s paper finds the origins of exclusive property rights in the basic concept of information costs. According to Mossoff, innovation is central to the American patent system, but current economic theories of patent law cannot account for the role it plays in shaping patent doctrine. Instead, Mossoff

suggests that the patent system promotes innovation by creating a default presumption that secures maximum liberty to a patentee in using its invention. Accordingly, patentees may engage in a broad array of exclusive licensing practices that reflect the fundamental use and alienation rights long secured to them as central patent entitlements under the normative policy of securing to patentees the fruits of their inventive labors. Where other theories of patents view the monopoly profits secured by patentees as simply the necessary evil in promoting inventive activity and receiving disclosure of these inventions through the patent systems *quid pro quo*, Mossoff sees patent exclusivity as a feature of a system plagued by uncertainty. According to the paper, the reward, prospect and commercialization theories of patents have all failed to explain the array of exclusive licensing practices long secured to patentees and the wide latitude given to patentees under the patent exhaustion doctrine, although the Denicolò and Franzoni paper in this very volume does offer some explanation. Mossoff's paper attempts to explain why expansive licensure rights were secured to patentees as a fundamental design principle of the patent system: the fundamental *ex ante* unpredictability of innovation. Inventors require substantial liberty in the free use and alienation of their property rights in order to adapt to the path of innovation. Although Mossoff does not draw economic conclusions, the implications are not only philosophical or historical: maximizing incentives for innovation requires the flexibility afforded by exclusive rights.

Henry Smith's paper focuses on a similar theme, again finding the roots of patent doctrine and theory in the fundamental uncertainty of the innovative process. The paper extends recent work on modularity in organization theory to explain how delineation strategies from property serve to manage information costs in intellectual property. For information cost reasons, it makes sense in

property law to deal with a wide range of problems using an exclusion strategy in which decision-making over discrete things is delegated to owners whose authority is protected by relatively simple on/off signals – like boundary crossings in the case of real property. By defining a right to exclude from a thing, many potential uses by the owner and various contractual partners can be protected without separate delineation. Only when use conflicts become large and private ordering is likely to fail can a system of governance rules be cost-justified, whether by regulatory, contract, or tort law. The basic presumption in property law, the right to exclude, serves to economize on information costs.

Smith's paper explains that, in effect, the exclusion strategy allows the system to manage complexity with *modularity*, with much information hidden in property modules and interactions governed by simple rules. As organizational theorists have increasingly emphasized, modularity helps to manage complexity in team production. By specifying interface conditions, a wide range of activities can occur in one module, making the system easier to use, more robust, and more flexible. Intellectual property, like property and organizational law, can be seen as a second-best solution of a complex coordination problem of attributing outputs to inputs. Seen in this way, the granting of alienable, well-defined, exclusive rights permits coordination at minimum cost and facilitates exactly the sort of valuable flexibility in the allocation of initial entitlements proposed by Epstein.

Finally, Scott Kieff addresses the same issues of information and coordination costs and likewise finds exclusive rights to be a solution. As Kieff notes, property rule treatment of intellectual property is sometimes said to cause a myriad of problems, including “excessive” transaction costs, thickets, anti-commons, hold-ups, hold-outs, and trolls, unduly taxing and retarding

innovation, competition, and economic growth. As Meurer, Lemley and Lichtman (in this volume) and others have suggested, such problems counsel for a shift towards some limited use of weaker liability rule treatment to facilitate transactions in those special cases where the bargaining problems are at their worst and where escape hatches are most needed. Kieff's paper, by contrast, suggests that over just the past few years, the patent system has been re-shaped from a system having several major, and helpful, liability-rule-pressure-release-valves, into a system that is almost devoid of significant property rule characteristics. The paper then explores some harmful effects of this shift, focusing on the ways liability rule treatment can seriously impede the beneficial deal-making mechanisms that facilitate innovation and competition. According to Kieff, the basic intuition behind this deleterious effect of liability rules is that they seriously frustrate the ability of a market-challenging patentee to attract and hold the constructive attention of a potential contracting party while preserving the option to terminate the negotiations in favor of striking a deal with a different party. In other words, property rules not only promote the incentives to create highlighted by Mossoff and ameliorate the cost of coordinating inputs outlined by Smith, but also enable an inventor to commercialize innovations. Such a regime thereby facilitates the relatively inexpensive reallocation of rights to more valuable uses.

IP and Antitrust: The regulation of SSOs

The final section of this volume operates as a sort of case study of the interactions of patent and antitrust rules in perhaps their most contentious setting: standard setting organizations (SSOs). Current controversies over patent policy place SSOs on a collision course with antitrust law. Recent theoretical research, particularly by Lemley and Shapiro (2007), asserts that in an SSO,

patent owners can “hold-up” patent users by demanding high royalties for a patented input after the SSO has adopted the patented technology as an industry standard and manufacturers within the SSO have incurred sunk costs to design end products that incorporate that standard. Various solutions to the purported problem have been proposed, implicating, generally, either weaker property rights or more antitrust enforcement. The SSO problem is necessarily complicated, not easily amenable to neat or elegant solutions—and, as some of the papers in this section suggest, may not be a problem at all. While this volume does not seek to address the underlying normative question of the desirability of SSOs per se, the papers in this section offer by implication some important justifications for SSOs. In keeping with the papers throughout this volume, SSOs are viewed here as solutions to information or coordination problems, and the rules governing what may and may not be done within the institution are scrutinized based on how well they likely facilitate the institution’s purpose. This is an important backdrop, and an essential lesson of this volume: Market institutions governed by simple rules that take seriously the difficulties of prescribing innovative behavior should not be interfered with lightly. Presumed problems must be evaluated against the effect of tinkering with institutional objectives.

Over the past few years, there has been an unprecedented degree of interest among competition authorities, scholars, SSOs, and trade associations with respect to the level of royalties that are charged by holders of intellectual property rights. In April 2007, the Department of Justice and the Federal Trade Commission jointly released a report on “Antitrust Enforcement and Intellectual Property Rights,” while the European Commission is currently investigating the compatibility of certain licensing regimes and conduct within SSOs against EC

competition law. Reflecting the debate at the policy level, scholars have produced a large body of legal and economic literature on IPR and standardization issues, including patent hold-up and royalty stacking (Kobayashi and Wright, 2009).

The first paper in this section, by Greg Sidak, looks at the dynamics of SSOs and finds a different institutional problem than the classic hold-up. Following on the dominant analysis, as Sidak discusses, some SSOs have recently sought no-action letters from the Antitrust Division for a variety of amendments to SSO rules that would require or request, at the time a standard is under consideration, the ex ante disclosure by the patent owner of the maximum royalty that the patent owner would charge under the regime of fair, reasonable, and nondiscriminatory (FRAND) licensing. This price information—which is characterized as the “cost” of the patented input—would, under at least one recent SSO rule modification, be a permissible topic for potential users of the patent to discuss when deciding whether to select it in lieu of some alternative standard. This exchange of information among horizontal competitors would occur ostensibly because the cost of the patented technology had been characterized as simply one more technical attribute of the standard to be set, albeit an important technical attribute. The US antitrust enforcement agencies have suggested applying the rule of reason to such conduct because such horizontal collaboration might avert patent holdup.

According to Sidak, however, this rule of reason approach is problematic because it conflicts with both the body of economic research on bidder collusion and with the antitrust jurisprudence on information exchange and facilitation of collusion. Put differently, because of their concern over the possibility of patent holdup, the U.S. antitrust agencies may be facilitating *oligopsonistic* collusion by

encouraging the ex ante exchange of information among competitors concerning the price to be paid for patented inputs. However, as the paper explains, neither the proponents of these SSO policies nor the antitrust agencies have offered any theoretical or empirical foundation for their implicit assumption that the social cost of patent holdup exceeds the social cost of oligopsonistic collusion.

Consequently, any efficiency defense that would be claimed in American antitrust law by SSO members accused of oligopsonistic collusion could encounter a court's considerable skepticism under the rule of reason. If a court did conclude that avoidance of royalty stacking, even on mere conjecture, is sufficiently certain to provide a compelling business justification for restraining trade in patented inputs to the SSO's standard, the remaining antitrust question would be whether there are alternative means to avert royalty stacking that do not facilitate oligopsonistic collusion. Sidak finds at least five promising alternatives. Given the analytical and factual uncertainty over whether patent holdup is a serious problem, and given the divergence of desired interpretations of antitrust law concerning SSO self-help responses to possible patent holdup, it is foreseeable that antitrust litigation on questions of first impression will arise and affect a wide range of high-technology industries that rely on SSOs. However, there is no indication that scholars and policy makers have considered the possibility that oligopsonistic collusion in SSOs is a larger problem than patent holdup.

Damien Geradin looks at the institutional arrangement of SSOs to assess the quality of claims that SSO's royalty-setting practices are problematic. The paper first looks at a number of concrete scenarios where firms holding IPRs seek to obtain a return on their patent portfolios by licensing them. As the paper suggests, the behavior of these firms depends on whether they are vertically-

integrated or non vertically-integrated. Vertically-integrated firms engage in research and development activities, patenting at least some of their inventions, and also manufacturing products based on their own innovations and the innovations produced by others. Non-vertically-integrated firms, in contrast, specialize in one or the other layers of production. Pure upstream firms conduct research and development activities and patent their innovations, but they do not engage in manufacturing. Downstream firms specialize in manufacturing, but do not engage in R&D.

Considering, again, the SSO as a solution to an information and coordination problem, Geradin offers additional insight into the sorts of problems and solutions imbued within SSOs by distinguishing types of firms—with different problems to solve. As it turns out, according to Geradin, the potential problems caused by strong patent rights and weak antitrust enforcement are mitigated by the dynamics of integrated firms.

Finally, Bruce Kobayashi and Joshua Wright look at the legal landscape governing SSOs, assessing the relative competency of different institutions and different laws to promote the efficient objectives of SSOs. Kobayashi and Wright begin by considering *Credit Suisse v. Billing*, a recent Supreme Court case in which the Court held that the securities law implicitly precluded the application of the antitrust laws to the conduct alleged in that case. In that case, the court considered several factors, including the availability and competence of other laws to regulate unwanted behavior, and the potential that application of the antitrust laws would result in “unusually serious mistakes.” Relying on the Supreme Court’s recent antitrust jurisprudence appearing to adopt error-cost analyses which are sensitive to the costs of false positives, Kobayashi and Wright extend and apply Easterbrook’s seminal analyses (Easterbrook 1983, Easterbrook

1984) of two of the most significant limitations on antitrust enforcement: error costs and federalism. The paper examines whether the considerations raised in *Credit Suisse* suggest restraint when applying the antitrust laws to conduct that is regulated by state contract laws and other federal laws. In particular, Kobayashi and Wright emphasize the availability of robust contract and patent remedies for SSO members who are the victims of contractual opportunism and the limited benefits of additional deterrence of SSO holdup afforded by antitrust remedies. While, as noted above, some have suggested that the conduct associated with patent holdup illustrates a gap in the current enforcement of the antitrust laws, Kobayashi and Wright conclude that contract and patent law offer superior substantive doctrine for identifying patent hold-up and distinguishing it from simple contract modification, and are likely to provide optimal deterrence without imposing serious risks of false positives.