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Evaluating the Public Impact of Open Innovation

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I'd like to start by thanking Beth Webster and Megan Richardson for bringing me out to Melbourne and for giving me this intriguing assignment. They asked me to talk about what intellectual property scholars would like to learn from econometricians.

Despite all my years of lecturing, I've spent inordinate amounts of time thinking about this presentation. It's quite a responsibility. Those of us in the intellectual property trenches have many questions about the economics of innovation that we'd like answered. Frankly, though, we're often disappointed with what we learn from economists. Empiricists work where data can be found, but that's not always where lawyers have questions. Theoreticians often construct models that don't capture what's difficult about the problems the law is addressing. Accordingly, actually being asked what I'd like to know more about is very welcome.

At the same time, I realize there are limits to what can be studied empirically. So, I'll start by telling you where I'd like to see more research. Then, I'll sketch out some of doctrinal, institutional and policy pay-offs from such work. Finally, I hope to persuade you that there are, in fact, "doable" projects by describing a few of the approaches that have been taken thus far.

So, where do I want more work? I'll start with a puzzle; a conundrum.

On the one hand, the impulse to commodify intellectual output is exploding. More and more segments of the knowledge domain are becoming the subject of intellectual property rights. At the same time, however, open innovation (by which I mean innovation outside the intellectual property law system) is flourishing. The puzzle is this: how can these trends be going on simultaneously? As appreciation for open innovation strategies increases, shouldn't demands for intellectual property protection decline? And even if demands don't decline, shouldn't lawmakers become more skeptical; more reluctant to accede to them?

My suspicion is that these conflicting trends are caused by the way in which we measure the value and the social impact of information produced in these two domains, the domains of open and proprietary knowledge. Evaluating the impact of proprietary information is, clearly, tricky. But those who participate in that domain are doing it in order to capture the benefits they generate, and these "capturing efforts" produce observable statistics. For example: patents and patent applications that we can count; royalty streams that we can measure; stock market prices that we can track. Sometimes, we can even measure the extent to which firms with intellectual property rights can raise prices above marginal cost.

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In contrast, measuring the value of knowledge that is not protected by formal intellectual property rights is a real challenge. There's no income stream; rewards are often hedonic, reputational, and only secondarily associated with quantifiable phenomena. The impact of that knowledge is, in other words, largely hidden—especially to policy makers.

So you asked me what I'd like, then, the answer is a more robust way of grappling with information generated outside the intellectual property system. I'd like to see the development of better indicators (metrics) of value. I'd like to understand more fully the role that this kind of innovation plays in economic growth and social welfare.

Quantifying information production in the open domain would allow us to identify the fields or sectors, or the areas within particular fields or sectors, where strong intellectual property rights are needed and as importantly, where they are not necessary (or could be fairly thin). Exclusive rights are associated with deadweight losses, transactional problems (negotiating rights thickets, dealing with holdouts), and diminished access, eliminating them where they are not needed—or reducing their strength—would improve the efficiency of research and the efficiency with which outputs translate into social welfare.

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I. The proprietary domain.

Exclusivity is growing at an accelerating rate: new rights are continuously being recognized and existing rights are expanding geographically, temporally, and substantively.

The geographic sweep is easiest to see: starting in 1995, every country in the World Trade Organization had to sign on to the TRIPS Agreement, and must now protect copyrights and neighboring rights, patents and breeders rights, as well as trademarks, trade secrets, geographic indications, industrial designs, and topographies. Even TRIPS' most ardent proponents, like the US, were required by the Agreement to raise their standards of protection; for developing countries, the changes required were much more dramatic. And TRIPS is not the end of the line: various bilateral agreements—free trade agreements and bilateral investment treaties—drive worldwide protection ever higher.

Domestic initiatives are equally significant. Take the three main areas of patents, copyrights and trademarks. Patents are moving increasingly upstream, to cover fundamental building blocks of knowledge (such as genetic and proteomic information). In addition, whole new fields are coming into the patent realm: software and business methods; diagnostic and surgical procedures; sports moves and tax dodges. There is currently a case before the US Supreme Court (*Bilski v. Kappos*[1]), where these expansions will be examined. At oral argument, the justices posed what they thought were humorous hypotheticals—about patents on dating schemes, teaching methods that don't put students to sleep, ways of calming horses. Little did they know, but there are actually patents on virtually everything they asked about. Other trends in the technical

[1] 545 F.3d 943 (Fed. Cir. 2008), cert. granted, 129 S.Ct. 2735 (2009),

area abound. They include demands for the protection of traditional knowledge and genetic resources.

In the copyright arena, the terms of protection are growing longer, and the protection is getting stronger. There are now criminal penalties for breaking into encrypted material (and for selling devices that do that); when in doubt, service providers must remove allegedly infringing material from the internet. And there are many new copyright-like forms of protection: performers' rights, rights of publicity, and rights in data bases. On the horizon, we have rights in fashion and in folklore to consider. Again, there are cases (*Eldred v. Ashcroft*[2] and *MGM v. Grokster*[3] in the US Supreme Court; *British Horseracing v. William Hill*[4] in the ECJ), so there is an awareness of a problem—but the courts are ineffective in cabining it and legislatures aren't even trying.

Much the same can be said about trademarks. Traditionally, trademark rights runs against consumer confusion, but now that includes "initial interest" and "post-sale" confusion. And right holders can win on rationales that have nothing to do with confusion: tarnishment and "blurring" (a phenomenon to which no cognitive psychologist has ever subscribed). There's also new subject matter: geographic indications, celebrity rights and sports rights. Once more, there are cases (*Moseley v. V-Secret Catalogue*[5] in the US Supreme Court; *Arsenal v. Reed*[6] in the ECJ), but the trend does not abate.[7]

What is happening?

Admittedly, these moves are partly a function of a changing business environment. Global marketing requires a broader geographic reach. When nations harmonize their laws, no one wants to unsettle expectations, so harmonization is always to the highest—rather than the lowest—existing level of national protection.

In addition, business models are changing. Branding is becoming a key merchandising technique. With more specialization, production moves along a value chain where intellectual property rights are good for coordination purposes. Since governments are less willing to fund universities, the academy has turned to their logos and faculty output as a source of revenue. Universities appear to represent both users and producers of intellectual property, so their Technology Transfer Offices (TTOs) are incredibly good at lobbying for enhanced protection. And then there are trolls (nonpracticing entitles). For complex products, intellectual property aggregators may be performing an important service. But because they are not knowledge producers, they never need access to

[2] Eldred v. Ashcroft, 537 U.S. 186 (2003).
[3] 545 U.S. 913 (2005).
[4] [2005] R.P.C. 13.
[5] 537 U.S. 418 (2003).
[6] [2002] All ER (D) 169
[7] See generally, Rochelle Cooper Dreyfuss, Reconciling Trademark Rights and Expressive Values: How to Stop Worrying and Learn to Love Ambiguity, in TRADEMARK LAW AND THEORY: A HANDBOOK OF CONTEMPORARY RESEARCH (Graeme B. Dinwoodie and Mark D. Janis, eds, Edward Elgar Publishing 2008).

protected materials. Accordingly, they—like TTOs—also see the expansion of rights as an unmitigated benefit.

In short, there's an important political dynamic favoring commodification. But the real issue is what makes it succeed? I think it is a perception about the essentiality of intellectual property rights to the economy.

First, there is a very strong belief that the only way to provide incentives to innovate is to protect innovators from free riders—that is, to recognize rights to exclude. Some of the judges on the US Court of Appeals for the Federal Circuit expressed that view when commenting on *KSR v. Teleflex*,[8] the Supreme Court case raising the standard of inventiveness (nonobviousness). Second, there is the notion that the only way to encourage disclosure is with intellectual property rights. A recent article puts it this way: "Without an intellectual property system, society would be starved for knowledge."[9]

Third, and in some ways most important, intellectual property rights are seen, essentially, as creating value. Take the "tee shirt" cases—disputes about whether merchandise bearing a team logo can be sold without authorization. Since no purchaser believes that the athletes actually knit the apparel bearing their logos, there's no real confusion about source (the traditional claim in trademark litigation). Nonetheless, the courts uniformly side with the teams. They see how much money merchandising rights generate: producer surplus is obvious.[10] But the courts are oblivious to the effect their decisions have on consumer surplus.

A second example is drawn from my experience on an advisory committee to the Secretary of Health and Human Services. Controlling healthcare costs is a big issue now in the US and my advisory committee is charged with looking at gene patents. The validity of gene patents is highly contested as a matter of patent law doctrine. Furthermore, and as I'll describe later, the need for gene patents isn't evident, while the cost is especially high. Geneticists, pathologists, family physicians, and patient advocacy groups have experienced significant holdup problems. Patent thickets make it difficult to offer multiplex tests and to report the results of whole-genome sequencing. But what attracts attention are the statistics presented by TTOs and pharmaceutical companies on the multi-million dollars that will be "lost" if the law interferes with gene patenting.[11] In fact, Biotech stocks lost 15 % of their value when Bill Clinton and Tony Blair questioned the validity gene patents[12]—reason enough, the patent bar says, to continue to award

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[8] 550 U.S. 398 (2007).

[9] Alan Devlin, the Misunderstood Function of Disclosure in Patent Law, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1490722 (October 2009) (going on to discuss problems in disclosure theory).

[10] See, e.g., Rochelle Cooper Dreyfuss, Expressive Genericity: Trademarks as Language in the Pepsi Generation, 65 Notre Dame L. Rev. 397 (1990).

[11] http://oba.od.nih.gov/SACGHS/sacghs_documents.html#GHSDOC_011. See also National Academies, Reaping the Benefits of Genomic and Proteomic Research: Intellectual Property Rights, Innovation, and Public Health, http://www.nap.edu/catalog.php?record_id=11487 and Patents in the Knowledge Economy, http://www.nap.edu/openbook.php?isbn=0309086361.

[12] http://www.mindfully.org/GE/2000-Review-Abate.htm

these rights. Again, observable benefits trump the value of reducing health care costs by making genetic tests more available to patients.

II. Open Innovation

As I've said, what's especially puzzling about this is that it is occurring at a time when alternative knowledge strategies are becoming increasingly visible, both in practice and in the law and economics literature. In the genetics context, much of the research is curiosity-driven; doctors also have strong commitments to patients and to evidence-based practice.[13] Nor are physicians alone in working for rewards outside the traditional intellectual property system. Perhaps the best known are the "peer production" guys – the writers of Wikis, like Wikipedia, and software like Linux, Apache, Firefox.[14] These projects were analyzed by Yochai Benkler, who found that volunteers will create outside the traditional intellectual property regime, so long as they are efficiently interconnected (e.g., through he internet) and participants are given a choice of projects of various length and difficulty.[15] Rewards are sometimes intrinsic (people enjoy creating for its own sake). And sometimes, the rewards are extrinsic, but they are not directly monetary: the systems are set up to rate contributors and promote their reputations. But of course, neither hedonic nor reputational benefits are easy to quantify.

Another model of open production has been identified by Eric von Hippel, who studies what he calls user (or lead user) innovation in a host of fields, from extreme sports to surgical equipment; library science to high-tech manufacturing. von Hippel found that these innovators don't need extrinsic incentives to produce—they want these advances for their very own use. As important, they also don't need incentives to disclose because sharing with others enlists new talents and skills, moving products up the quality ladder faster.[16] Again, the benefits are clear, but difficult to measure.[17]

Since the "discovery" of peer production and user innovation, a virtual cottage industry has sprung up of people looking for intellectual production outside the intellectual property context. Among other enterprises, they've studied university research (Fiona Murray, Scott Stern, and of course, Robert Merton); the fashion industry (Kal Rustiala, Chris Sprigman, Scott Hemphill, Jeannie Suk, Jonathan Barnett); comedy (Sprigman and Dotan Oliar); cuisine (von Hippel, Christopher Buccafusco); magic (Jacob Loshin);

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[13] David Leonhardt, Dr James Will Make It Better, NY Times Magazine, Nov. 8, 2009 at p.31-37; 44-47 (describing the development and dissemination of nonprotected treatment protocols)

[14] Iaian M. Cockburn, Blurred Boundaries: Tensions Between Open Scientific Resources and Commercial Exploitation of Knowledge in Biomedical Research, http://people.bu.edu/cockburn/cockburn-blurred-boundaries.pdf (April, 2005).

[15] Yochai Benkler, Coase's Penguin, Or, Linux and the Nature of the Firm, 112 Yale L.J. 369 (2002).

[16] Eric von Hippel DEMOCRATIZING INNOVATION (2005); Fred Gault & Eric von Hippel, The Prevalence of User Innovation and Free Innovation Transfers: Implications for Statistical Indicators and Innovation Policy, available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1337232; Jeroen P.J. de Jong & Eric von Hippel, Transfers of User Process Innovations to Process Equipment Producers: A Study of Dutch High-tech Firms, _ Research Policy _ 2009), available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1352496.

[17] Other contributors include Robert Allen, who first identified what he called "collective innovation" in the steel industry; also Josh Lerner, Fred Gault, Dick Nelson, Peter Meyer, and Robert Gault.

farming and traditional knowledge (Dan Kevles, Graham Dutfield, Colin Golvan, Rosemary Coombe).[18]

But the researchers have mainly studied the norms undergirding these systems and (sometimes) the private rewards animating them. They have not studied the public impact in a systematic way: is there the same level of social value that we see with products subject to standard intellectual property rights, or are the fruits of this work too idiosyncratic to its inventors, or too poorly disseminated to be of much public value? Given the absence of transaction costs, is the public impact of these initiatives higher than work protected by proprietary regimes? Different in some other respect?

III. Please be clear. I am not saying that all innovation could be produced this way. But the conundrum of proprietary expansion in the face of open source development is intriguing, and, to my mind, an important area for further study. The potential policy pay-offs are significant. With better metrics and measurements, with the ability to compare development in open and proprietary domains we could improve the efficiency of R&D spending.

Take the subject matter debate: it would be much easier to do what the *Bilski* Court is attempting—to decide what kinds of work should qualify for patent protection—if we knew what was best accomplished in a proprietary model, and where an open innovation strategy works (or, works better). Scope, defenses, and remedies questions could also be usefully informed by better measures of the social impact of innovation that is in a "publicly accessible domain" (in the public domain, a commons, or subject to nonexclusive licensing on reasonable and nondiscriminatory terms).

Then there is the term of protection. In *Eldred*, the Supreme Court case challenging copyright term extension, Justice Breyer attempted to measure the impact of public availability. He cited the potential users of the works that became subject to extended protection (movie and jazz buffs, scholars, historians, teachers, writers, artists, database operators, researchers). He looked at how many editions were published after copyright expiration. And he discussed the flip side, the "costs to education, learning and research" of extending the copyright term. But these were gestures; he lacked quantitative tools. He had nothing to counter the evidence that works on the verge of expiration were still earning billions of dollars. The observable private value deriving from term extension swamped arguments about the social value of putting the works in the public domain—— Justice Breyer's opinion was, at the end of the day, a dissent.

Finally a better grasp of the social impact of open innovation might lead us to develop affirmative support for the institutions required for efficient knowledge production in that realm: government financing; laws that protect collaborators from exploitation and assure that they secure credit for their work; laws that smooth the interaction between the open and closed domains; and legal measures that foster information commonses. A better

[18] For a discussion of the work by these scholars, see Rochelle Cooper Dreyfuss, Does IP Need IP? Accommodating Intellectual Production Outside the Intellectual Property Paradigm, _ Cardozo L. Rev. _ (forthcoming 2010).

understanding may also help developing nations cope with (or counter) rising international demands for stronger protection.

IV. I hope I've convinced you that open innovation is an area worthy of your attention. Obviously, I'm not an econometrician, but existing research suggests many viable strategies for exploring this domain

One methodology is case studies. The advisory committee I mentioned before commissioned a study to compare the development of genetic diagnostic tests for diseases where the relevant genes are patented to the development of tests when the genes were not patented. The study, which was conducted by Robert Cook-Deegan and coauthors, will be available at the time when the HHS Report is published. From the draft of the Report that was posted for public comment, one can deduce that the studies suggest that patenting is not needed to motivate the development or perfection of diagnostic tests. Indeed, as compared to the situation where patented genes are exclusively licensed, open innovation produces more types of tests and greater accessibility.[19]

Event studies are another promising approach. Fiona Murray and various co-authors measured the impact of open innovation on further, upstream work by comparing citation rates (or the numbers of researchers or lines of research) before and after the occurrence of an event that changed the level of protection. For example, in papers with Scott Stern and Kenneth Huang,[20] she looked at citation rates before and after a patent issues. The authors found that before intellectual property protection kicks in, the information in the articles is cited more often than it is afterwards. The negative impact of patenting is particularly strong for patents owned by the private sector (where, the authors posit, enforcement is perceived to be more likely) and especially when rights are fragmented among many owners and, for gene patents, when the genes are closely linked to human disease.

In other work she looked at the opposite fact pattern: the "openness shock" produced by sudden decisions by the holders of patents in genetically-engineered mice to make available to academic researchers rodents that had previously been fiercely protected. After the "openness shock," the authors saw an increase in citation rates and—most interestingly—an increase in the diversity in researchers and research lines. They suggest that free availability of key research inputs makes researchers more willing to take risks, to explore remote applications of the (now free) technology.[21]

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[19] Cook-Deegan also looked for effects of patenting on price. However, he examined testing only in the United States, where fees are pegged to insurance reimbursement rates.

[20] Fiona Murray and Scott Stern, 63 J. Econ. Behavior & Organization, 648-687 (2007); Kenneth G. Huang, Fiona E. Murray, Public Policy: Does Patent Strategy Shape the Long-Run Supply of Public Knowledge? Evidence from Human Genetics, 52 Academy of Management J _ (2009), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1249522

[21] Fiona E. Murray, Philippe Aghion, , Mathias Dewatripont, Julian Kolev, and Scott Stern, Of Mice and Academics: Examining the Effect of Openness on Innovation (May 2009). NBER Working Paper Series, Vol. w14819, pp. -, 2009, http://ssrn.com/abstract=1369055.

Paul Heald has taken a somewhat similar approach.[22] His "event" is copyright expiration. He's compared the number of editions of written work, the number of publishers, and library shelf space; for music, the number of times works appear in movies before and after expiration.[23] He too finds that diffusion improves once work is in an open domain—and that is true even though he looked at works that were quite old. Heald hasn't done it, but like Murray, one could also do the opposite: compare the usage of works that came back into copyright when the US complied with the TRIPS Agreement by enacting the Copyright Term Restoration Act.[24]

Note that much of the work I've described so far involves straightforward citation studies. Use of citations is also becoming sophisticated in ways that could be helpful for exploring open innovation. Kathy Strandburg, for example has taken a network science approach to patent citations. [25] Comparing her findings with citations of open projects would be particularly interesting because it would show not only differences in use, but also differences in clustering and diffusion patterns.

Event studies can also be conducted using the market valuations of firms poised to utilize information that suddenly falls into the public domain.[26] One provocative datum: in 1994, Apple sued Microsoft over rights to the graphic user interface. When the court decided there was no infringement, the stock prices of BOTH companies rose: in that instance, it was clear just how much the entire industry valued open access to the fruits of R&D.

Of course, one of the most obvious methodologies for exploring open innovation is the use of surveys. Eric von Hippel, for example, is measuring the impact of user-generated innovation by asking technology based firms questions about how much they invest in developing or modifying equipment for their own use; how often they share their research results with others; what forms of compensation they expect to see from these transfers; and whether intellectual property protection was sought. His work suggests that there is significant invention and collaborative development outside the intellectual property system, and that spending on open process-type innovations is a significant portion of total R&D expenditure.[27]

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[22] The Murray studies, which have not been done justice here, take a differences-in-differences approach. Heald's analysis is somewhat different.

[23] Paul J. Heald, Property Rights and the Efficient Exploitation of Copyright Works: An Empirical Analysis of Public Domain and Copyrighted Fiction Best Sellers, 92 Minn. L. Rev. 1031 (2008)[time periods are 1913-1922 and 1923-1932, as used from 1988-2001); Paul J. Heald, Does the Song Remain the Same? An Empirical Study of Bestselling Musical Compositions (1913-32) and Their Use in Cinema (1968-2007).

[24] 17 USC § 104A.

[25] Katherine Strandburg, Gábor Csárdi, Jan Tobochnik, László Zalányi and Péter Érdi, Modeling Innovation by a Kinetic Description of the Patent Citation System, 374 Physica A 783 (2007) and Law and the Science of Networks: An Overview and an Application to the "Patent Explosion, 21 Berkeley Technology Law Journal 1293 (2007)

[26] Cf. James Bessen & Michael J. Meurer, Patent Failure: How Judges, Bureaucrats, and Lawyers Put Innovators at Risk (Princeton University Press 2008).

[27] See Gault and von Hippel, supra note 16

I should add that there is also survey work by Wes Cohen and John Walsh that tends to contradict Murray's conclusions. Their work, which surveyed scientists who headed laboratories in the biotechnology field, suggests that upstream innovation is not affected by whether research inputs are protected—that within academia, the reigning norm is to "ignore patents." [28] Their subjects said they've never abandoned work or experienced delays on account of patents.

If nothing else, it would be good to figure out why different methodologies lead to different conclusions. One can, of course, always speculate. The laboratory heads that Cohen and Walsh interviewed may not be knowledgeable enough about patents to respond accurately. For example, they do admit there are delays, but attribute them to material transfer agreements, which, in fact, also protect exclusivity and are often used to safeguard patent rights. Alternatively, it might be that grad students and post-docs are better positioned than lab heads to feel the effects of patenting. Or perhaps Cohen and his coauthors asked the wrong question. Maybe research is never begun when there is a suspicion that various inputs will be patented—a result that dovetails with Murray's findings.

Technology transfer offices may also have their uses. They also face measurement problems: they are usually judged by the royalties that are generated by the intellectual property licenses they negotiate. But some TTOs are experimenting with other metrics, and perhaps there experience could be utilized by econometricians. For example Carol Mimura, who runs technology transfer operations at UC Berkeley, is working on performance measures that capture the value of putting university inventions in a more accessible domain.[29] Among other things, she looks at gifts that Berkeley attracts as a result of its faculty's public-regarding research. For medical inventions, she also considers the impact of the work on the global disease burden (a measure also suggested by Thomas Pogge[30]). And since Berkeley engages in dual licensing strategies, she can estimate the social impact of the open regime from the income stream generated on the proprietary side.

There are other sources of information that might be exploited. The Creative Commons, which permits writers (and increasingly scientists) to make their materials openly available, keeps reams of data on how their licenses are used. Hospitals generate and openly share health-care protocols; they also keep data on the costs savings these protocols produce. Companies have instituted initiatives, like 3M's Innovation Center and the Lego Factory,[31] which harness information from customers (in von Hippel's

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[28] Wesley M. Cohen & John P. Walsh, Real Impediments to Academic Biomedical Research, 8 Innovation Policy and the Economy 1 (2007); Wesley M. Cohen & John P. Walsh, Access—or not—in Academic Biomedical Research, in WORKING WITHIN THE BOUNDARIES OF INTELLECTUAL PROPERTY (Rochelle Dreyfuss, Harry First and Diane Zimmerman, ed., forthcoming Oxford University Press 2010).

[29] Carol Mimura, Nuanced Management of IP Rights: Shaping Industry-University Relationships to Promote Social Impact, in Dreyfuss et al., supra note 28.

[30] Thomas Pogge, Could Globalisation Be Good for World Health, http://www.theglobaljusticenetwork.org/wp-content/uploads/1_pogge.pdf.

[31] http://www.lego.com/eng/info/default.asp?page=productsdetail&contentid=32962&langcode=all; http://www.3m.com/cms/ca/en/1-30/crcFzFW/view.html.

terms, classic user-innovators). These firms have likely developed ways of evaluating what they learn.

Conclusion

As I said at the outset, it is not easy to measure the value of knowledge developed in the open environment or the impact of open innovation on knowledge production. In the legal and policy space, that invisibility makes demands for enhancing intellectual property protection almost impossible to refuse. And the arguments for retrenching (reducing the current level of protection) are dismissed out of hand.

I'm a transactional pessimist: I don't think it's easy to contract around malformed intellectual property rights, and so what I'd most like to see is more empirical work on the capacity of innovation outside the intellectual property system to fuel knowledge production and economic growth, and to improve social welfare.

Thanks again for asking.