1. IP in a world without scarcity

Mark Lemley*

1. INTRODUCTION

Economics is based on scarcity. Things are valuable because they are scarce. The more abundant they become, the cheaper they become. But a series of technological changes is underway that promises to end scarcity as we know it for a wide variety of goods. The Internet is the most obvious example because the change there is furthest along. The Internet has reduced the cost of reproduction and distribution of informational content effectively to zero. In many cases it has also dramatically reduced the cost of producing that content. And it has changed the way in which information is distributed, separating the creators of content from the distributors. On the Internet today, a variety of intermediaries like search engines and web hosts enable access to information for free or at a very low cost. Those intermediaries are agnostic about (and quite often ignorant of) the content they are distributing. In short, the Internet has not only slashed the cost of creation, production, and distribution; it has also disaggregated creation and distribution. I can create without distributing, secure in the knowledge that my works will be disseminated by others who distribute without creating.

More recently, new technologies promise to do for a variety of physical goods and even services what the Internet has already done for information. 3D printers can manufacture physical goods based on any digital design. While home 3D printers are so far quite limited in size and materials, there are tens of thousands of printing designs available on the Internet already, and larger commercial-scale printers can print anything from circuit boards to rocket engines to human organs on site for the cost of the raw materials and some electricity.

* This is an abridged version of an article first published in the New York University Law Review, and the reader is referred there for more detailed discussion.
3D printing shares two essential characteristics with the Internet: it radically reduces the cost of production and distribution of things, and it separates the informational content of those things (the design) from their manufacture. Between the Internet, 3D printing, robotics, and synthetic biology, it is entirely plausible to envision a not-too-distant world in which most things that people want can be downloaded and created on site for very little money—essentially the cost of raw materials. Jeremy Rifkin calls this the “zero marginal cost society.” The role of IP in such a world is both controverted and critically important. IP rights are designed to artificially replicate scarcity where it would not otherwise exist. In its simplest form, IP law takes public goods that would otherwise be available to all and artificially restricts their distribution. It makes ideas scarce because then we can bring them into the economy and charge for them, and economics knows how to deal with scarce things. So on one view—the classical view of IP law—a world in which all the value resides in information is a world in which we need IP everywhere, controlling rights over everything, or no one will get paid to create.

That has been the response of IP law to the Internet so far, but that response is problematic for a couple of reasons. First, it does not seem to be working. By disaggregating creation, production, and distribution, the Internet democratized access to content. Copyright owners have been unable to stop a flood of piracy, even with 50,000 lawsuits, a host of new and increasingly draconian laws, and a well-funded public education campaign that starts in elementary school. They might have more success targeting the intermediaries rather than the individuals consuming content, but because those intermediaries distribute content without regard to what it is, IP law can block piracy there only at the cost of killing off what is good about the Internet. Utility patent and design patent owners may soon face the same conundrum: unless they strictly control and limit the sale and manufacture of 3D printers, they may find themselves unable to prevent the production of unauthorized designs. And even targeting the intermediaries may prove futile; among the things you can print with a 3D printer is another 3D printer. The world of democratized, disaggregated production may simply not be well suited to the creation of artificial scarcity through law.

Second, even if we could use IP to rein in all this low-cost production and distribution of stuff, we may not want to. The rationale for IP has

---

always been not to raise prices and reduce consumption for its own sake, but to encourage people to create things when they otherwise wouldn’t. More and more evidence casts doubt on the link between IP and creation, however. Empirical evidence suggests that offering money may actually stifle rather than encourage creativity among individuals. Economic evidence suggests that quite often it is competition, and not the lure of monopoly, that drives corporate innovation. The Internet may have spawned unprecedented piracy, but it has also given rise to the creation of more works of all types than ever before in history, often by several orders of magnitude. Perhaps the Internet has so reduced the cost of creation that more people will create even without an obvious way to get paid. Or perhaps they never needed the motivation of money, just the ability to create and distribute content. Either way, if the goal of IP is to encourage the creation of new works, the example of the Internet suggests that for an increasingly important range of creative works, radically reducing the cost of production decreases rather than increases the need for IP law.

Some scholars have responded to doubts about the traditional justification for IP by offering alternative justifications for IP. But the most common alternatives fare no better than the incentive story in this new world. Commercialization theory, which postulates that we need IP not to encourage creation but to encourage production and distribution of works, is particularly vulnerable to disruption by cost-reducing technologies like the Internet, 3D printers, and gene printers. It may once have been true that even if a book was cheap to write, printing and distributing it took a substantial investment that had to be recouped. But the development of technologies that disaggregate creation from production and distribution, and reduce the cost of the latter to near zero, mean that commercialization-based theories cannot justify IP in the face of new technologies. And the theory that we need IP rights to prompt disclosure of things that would otherwise be kept secret also seems rather quaint. Perhaps it made sense in a world where transmission of information was difficult, but in a world in which information flows freely, keeping secrets becomes the exception rather than the rule.

Far from necessitating more IP protection, then, the development of cost-reducing technologies may actually weaken the case for IP. If people

---

are intrinsically motivated to create (as they seem to be), then the easier it is to create and distribute content, the more content is likely to be available even in the absence of IP. And if the point of IP is to encourage either the creation or the distribution of that content, cost-reducing technologies may actually mean we have less, not more, need for IP.

None of this is to say that IP will, or should, disappear entirely or overnight. The cost of producing and distributing content has fallen (and will continue to fall) at uneven rates. Some content, like blockbuster action movies and video games, may be expensive to make for years to come. Other content, like pharmaceuticals, may remain expensive because regulatory barriers raise the cost even as design and manufacturing become cheap. 3D printing, too, may work cheaply and easily for some kinds of goods but less well for others, at least at first. And the case for IP is at its strongest for things that are very expensive to make but cheap to copy. But increasingly, those justified instances of IP will become islands in a sea of cheap goods, content, and even services delivered to your home in the form of digital information.

I have argued elsewhere that IP rights are a form of government regulation of market entry and market prices. We regulated all sorts of industries in the twentieth century, from airlines to trucking to telephones to electric power, often because we couldn’t conceive of how the industry could survive without the government preventing entry by competitors. Towards the end of that century, however, we experimented with deregulation, and it turned out that the market could provide many of those services better in the absence of government regulation. The same thing may turn out to be true of IP regulation in the twenty-first century. We didn’t get rid of all regulation by any means, and we won’t get rid of all IP. But we came to understand that the free market, not government control over entry, is the right default position in the absence of a persuasive justification for limiting that market. The elimination of scarcity will put substantial pressure on the law to do the same with IP.

A world without scarcity requires a major rethinking of economics, much as the decline of the agrarian economy did in the nineteenth century. How will our economy function in a world in which most of the things we produce are cheap or free? We have lived with scarcity for so long that it is hard even to think about the transition to a post-scarcity economy. IP has allowed us to cling to scarcity as an organizing principle

---

in a world that no longer demands it. But it will no more prevent the transition than agricultural price supports kept us all farmers. We need a post-scarcity economics, one that accepts rather than resists the new opportunities technology will offer us. Developing that economics is the great task of the twenty-first century.

In Section 2, I discuss the traditional economics of scarcity and outline the new technologies that are poised to create an economics of abundance. In Section 3, I explore how IP will and should react to those new technologies, using evidence from the Internet as an example. Finally, in Section 4, I offer some speculations both as to what an economics of abundance would look like and what role IP might play in such a world.

2. BEYOND SCARCITY

2.1 The Traditional Economics of Goods and Information

Our economy is based on scarcity. We pay for things because it takes resources—land, raw materials, human labor—to produce them. In general, the more resources it takes to produce them, the more we pay. The most fundamental graph in economics shows a supply curve and a demand curve. The supply curve slopes up because resources are scarce, and the demand curve slopes down because money too is scarce. Generally speaking, markets meet in the middle—when it costs more to make something than people are willing to pay for it, manufacturers stop making it. When there are exceptions—when customers are willing to pay a great deal for something that is cheap to make—the producer may make a substantial profit in the short term. But in the long run, other producers, attracted by the high profit margin, enter and offer the cheap product at a lower price, competing away the extra profit margin. Price settles at marginal cost.

The economics of information are somewhat different. Information is a public good; that is, ‘one that is non-rivalrous and difficult to exclude non-payers from using.’ Unlike, say, ice cream, my consuming information doesn’t prevent you from also consuming it. Accordingly, the marginal cost of producing information approaches zero (though the physical goods in which information has traditionally been encapsulated, such as books, do cost money to produce and distribute).

---

Economists worry that things—goods or information—that cost a lot to develop but little or nothing to copy will be underproduced because the ease of copying means producers won’t be able to charge enough to recoup their investment in making the thing in the first place. In effect, the point of IP laws is to take a public good that is naturally nonrivalrous and make it artificially scarce, allowing the owner to control how many copies of the good can be made and at what price. In so doing, IP tries to fit information into the traditional economic theory of goods. The fit is imperfect, though, both because IP’s restriction on competition creates a deadweight loss to consumers who would have bought the good at a lower price and because the very existence of the IP right means that competition cannot discipline pricing in the same way it does for goods.

A series of technological changes promise to remake this basic economics in the coming decades. They will do so not by repealing the basic laws of economics, but by fundamentally changing both the cost and the nature of the supply side of the equation.

2.2 The Internet and Information Economics

I begin with the most familiar example: the Internet. It has become trite to observe that the Internet has remade the economics of information.

Before the Internet, the creation and distribution of content was a large-scale business operation. While anyone could write a song or a movie script, actually producing a record or a movie required commercial facilities. Further, even for industries where the creation of content was fairly cheap (say, writing a book, which didn’t require much more than a typewriter), distributing that work to a wide audience required a commercial network. Writing a book may have been cheap, but printing that book required a substantial factory, and distributing it to the masses required a fleet of trucks and a network of brick-and-mortar stores. And the companies that owned those factories, trucks, and stores invested the most in producing and distributing a work and accordingly took the lion’s share of the revenue from the sale of that work (often 80 percent or more, as with major-label record and book publishing contracts).

Notably, it was not just the distribution of legitimate copyrighted content that required a substantial investment; counterfeiting did too. Anyone who wanted to sell fake records or counterfeit books in the 1970s had to invest in a facility to manufacture the physical goods, a network to distribute those copies to “retailers,” and a group of people to sell the goods—all while avoiding the watchful eyes of the police. True, the retailers may have had lower overheads operating from a card table on a street corner than they would operating from a permanent store. But
as counterfeiters grew in scale, they faced increased costs and a greater chance of detection.

The Internet brought two related changes that fundamentally altered this dynamic. First, the rise of digital media permitted the separation of the act of creation from the acts of production and distribution. A new creative work could now be instantiated entirely as information, rather than as a physical product that itself had to be reproduced. Creative works had (mostly) always existed as conceptual things separate from their physical form; the 1976 Copyright Act makes it clear that the copyrighted “work” is separate from a “copy” that embodies that work, even if (as with an oil painting) the only embodiment of the work is in that physical copy. Buying a physical copy of something—even the only physical copy—doesn’t give you rights in the copyrighted work embodied in that copy. But with the rise of digital technology, the work could be created entirely as information. This happened first with text; books have been written in computers rather than on paper for some time. Today, music, movies, and art can all be made entirely of information.

This led to a second, related change: the democratization of content distribution. Once a work could be instantiated entirely in information, the copying of that work no longer required a factory to produce it or a fleet of trucks and stores to distribute it. The work could be transmitted to others with no loss of quality and at virtually no cost. The fact that distribution was so cheap, in turn, meant that anyone could do it. Artists didn’t have to distribute their own work (or have book publishers or record companies do it for them). Anyone can (and almost everyone does) distribute content in digital form.

The combined effect of these changes was to fundamentally alter the economics of the creative industries. Existing content is no longer scarce. Once created, it costs virtually nothing to reproduce, and anyone can copy and distribute it. On the one hand, this is an enormous boon to artists. You no longer need to turn over 80 percent of your revenues to a major-label record company in exchange for the company mass-producing hundreds of thousands of plastic discs and shipping them to retail stores around the country. Want your music available to a global audience? Click a few buttons and it’s done.

On the other hand, the democratization of content distribution has also fundamentally changed the nature of IP infringement. Counterfeiters, too, no longer need to build factories or hire trucks and teams of retailers. Indeed, counterfeiting as a business seems in just as much jeopardy as the major record labels from the rise of the amateur copyist. The democratization of copying and distribution has made it far easier than...
ever before in history to communicate content to others. But by eliminating scarcity, it may have made it harder than ever before to get paid for doing so.

2.3 The Coming Information Economics of Things

While the changes the Internet has wrought in digital content are well known, what is less well known is that a similar set of changes is poised to sweep through the economy of goods. Perhaps the best known of these new technologies is 3D printing. As the name suggests, 3D printing is a developing technology that converts information into a physical item, just as regular computer printing does—with the twist that the physical item exists in three dimensions rather than only two. A typical 3D printer will use as input a form of extruded plastic. The user loads a blueprint into the computer attached to the 3D printer, and the printer deposits the plastic, layer by layer, until it has made a 3D object.

3D printing is in its infancy as a technology, but already the potential for transformation is clear. Cheap, home 3D printers can already print spare parts, small sculptures, and a variety of household goods. 3D printers can print operable mechanical objects, including clocks and (infamously) a plastic gun. Larger, more expensive 3D printers, though once mostly in use at manufacturing facilities or at foundries like Shapeways, are also available for consumer use at Staples. They can print from a variety of different raw materials, including metal powders, fabrics, and even paper that can simulate wood products, and can therefore make much more complicated devices. People print anything from clothes to kayaks. 3D printers are even printing functional electronic equipment. Some manufacturing facilities have switched to making complex devices such as jet turbines and rocket engines on 3D printers because the printers replicate things exactly every time and therefore reduce error tolerance. The ground-up assembly process makes it possible to print shapes that cannot be cut or shaped from a block of existing material. Companies today even 3D print artificial human limbs and organs.

While the current state of 3D printing makes it useful only for certain types of products, there is reason to think that 3D printing will become both cheaper and better in the not-too-distant future. 3D printers look right now like the computer industry did in 1976—a set of large, expensive machines used by businesses and a fringe of cheap, homemade computers used primarily by hobbyists. But computers rapidly joined the mainstream in the 1980s as processing power increased and size and cost decreased, making a personal computer a plausible investment.
We should expect similar trends in 3D printing. The raw materials for most applications are relatively cheap. Printer designs and products that can be designed on them are increasingly available. The range of things that can be 3D printed will grow rapidly; one company began 3D printing human organs in 2013, and there is even a prototype of a 3D printer that can print a house. Researchers are working on 3D printers that can print food. The development of commercial printers and their increase in use should reduce the cost of manufacturing more sophisticated printers, and as demand grows, economies of scale should bring the cost down even further. Most notably, 3D printers can even print the parts for assembling new 3D printers, which suggests that 3D printers can effectively improve themselves over time.

A world in which sophisticated 3D printers are widely available would change the economics of things in a fundamental way. 3D printers, like the Internet, separate things into their information content and their manufacturing. By doing so, they eliminate the cost of distribution (since the thing of interest can be printed on site) and substantially reduce the cost of manufacturing (since the only costs will be the raw materials and electricity). Like the Internet, the democratization of production of things can be both good and bad. A world in which everyone has advanced 3D printers at home or available in a public facility is a world in which manufactured goods no longer have to be produced in bulk and are no longer scarce. But it is also a world in which the manufacture and sale of newly designed things becomes harder and harder to control. All someone needs to do is download a design from the Internet and they can print that design without paying. Deven Desai and Gerard Magliocca have already described the resulting Napsterization, but while the Napster music file-sharing service and the Internet implicated copyright law, 3D printing is likely to affect the owners of utility patents and design patents, which cover the making of physical things.

5 Deven R. Desai & Gerard N. Magliocca, ‘Patents, Meet Napster: 3D Printing and the Digitization of Things’ (2014) 102 The Georgetown Law Journal 1691, 1692, 1718 (describing the “digitization” of things and comparing 3D printing sites to Napster); James Grimmelmann, ‘Indistinguishable from Magic: A Wizard’s Guide to Copyright and 3D Printing’ (2014) 71 Washington and Lee Law Review 683, 696 (“Music and movies have had enforcement problems in spades since Napster … Now that the world of bits is colonizing the world of atoms, the makers of things are about to learn that they are less special than they may have thought. They confront exactly the same enforcement challenges …”).
3. IP IN A POST-SCARCITY WORLD

3.1 The Internet Experience

If technology offers a world in which goods and services are no longer scarce, how should IP law respond? Basic IP theory suggests a clear answer: A world in which content is separated from production needs more and stronger IP to restore the scarcity we have lost. The logic goes like this. IP is designed to solve a public goods problem that arises because it is cheaper to be an imitator than an inventor. The greater the disparity between the cost of inventing or creating and the cost of copying, the more need there is for IP to encourage people to be creators rather than imitators. In effect, IP law artificially raises the cost of imitation in order to make it at least as costly as creation.

3D printing exacerbates the public goods problem of IP theory by making it much cheaper to imitate than to create. Standard IP theory predicts that lots of people will engage in illegal copying but no one will create under those circumstances, so we must artificially increase the cost of production and distribution by strengthening IP rights to rebalance incentives. And because the technology makes reproduction and distribution so cheap and easy, we must increase the cost a lot in order to restore the scarcity that is the foundation of our economic order.

We have seen these arguments play out with the Internet. Consistent with IP theory, as the cost of reproduction and distribution dropped to zero, piracy became rampant on the Internet. The companies that produced content in the pre-Internet world worried that they could not make money in an environment where copying was so easy. Many have lamented the Internet as the end of the content industries, and indeed some (though not all) of those industries saw their revenues decline as consumers switched from buying content in physical form to downloading it, often for free.

The content industries responded just as IP theory said they should. In the US, such industries persuaded Congress to pass a multitude of new laws, criminalizing copyright infringement on the Internet even if done for no financial gain and ramping up the penalties for copyright infringement to an extreme degree. They filed tens of thousands of lawsuits against people who posted copyrighted content online. They sued anyone with even a vague connection to the pirates, from sellers of software to content-hosting services, to search engines, to providers of Internet access, to the lawyers and venture capitalists who supported those intermediaries. They even sought to change the basic nature of the
Internet itself, seizing entire Internet domains and proposing legislation 
that would have prevented Internet sites from connecting to each other. 

It didn’t work. Copyright infringement remains rampant on the Internet. 
The reason is simple: the democratization of content distribution. The 
content industry sued tens of thousands of file sharers, and may well have 
deterred those it sued, but there were tens of millions of people sharing files. 
It persuaded the government to seize thousands of Internet domains, but 
many more were beyond the government’s reach. It sued and shut down 
dozens of software providers, but there were always more who stepped in to 
take their places. And while it is possible that some of the more draconian 
measures the content industry has tried—suing the people who provide 
Internet service, or passing legislation to prevent interconnection 
altogether—would have eliminated that democratization, those measures 
have so far failed, simply because they would destroy so much social value 
along with reducing copyright infringement. The result was that as marginal 
costs for online content declined to zero, prices too dropped to zero—first 
for pirated content, but increasingly for legitimate content.

According to IP theory, the result is predictable: with rampant infringe-
ment and no effective way to block it, the Internet should have dramatic-
ally weakened the incentive to create new content. But the Internet 
carries a surprising lesson for IP theory: despite the prevalence of 
infringement and the teachings of IP theory, people are creating and 
distributing more content now than ever before, by at least an order of 
magnitude. Economic scholarship suggests that while recording industry 
revenues have declined substantially from their high in 1999, there are 
more songs being released than ever before, more new artists than ever 
before, and more purchases of music than ever before, and the songs 
released seem to be of at least as high quality as before the Internet. The 
rise of sites like YouTube has led to an astonishing outpouring of videos 
from outside Hollywood, to such an extent that more than 300 hours of 
new content is uploaded to YouTube every minute; more content is 
added to YouTube every month than the major TV networks created in 60 
years. At the same time, the movie industry is faring better than ever 
before in history, with profits at an all-time high and more movies being

---

People are buying more books than ever before, thanks in substantial part to Internet downloads. And while the price of those books has declined somewhat, writers are also publishing more books than ever before, including a surprising number of successful self-published books. Print newspapers have seen revenues decline because of the Internet, but that doesn’t mean news reporting has declined; more news is reported more quickly from more sources as individual citizens are increasingly capable of documenting the world around them. Nor has the quality of journalism necessarily fallen; indeed, one recent study finds that ‘newspaper content appears to be getting more sophisticated in response to increased Internet penetration.’ And despite piracy, both the film and publishing industries reported higher profit margins in 2012 than they did a decade before. Live music and shows have also reached unprecedented levels of revenue and profit. Overall, the picture of the entertainment industry is far from bleak; the overall industry grew from $449 billion in 1998 to $745 billion in 2010.

Perhaps most surprising, people are creating an astonishing array of content specifically for the purpose of giving it away for free on the Internet. Early on, scholars worried that no one would create content for the Internet because they couldn’t see a way to get paid, but it is hard to think of a prediction in all of history that has been more dramatically wrong. People spend hundreds of millions—or even billions—of hours a

---


9 E-Reading Rises as Device Ownership Jumps (Pew Res. Ctr, Jan 16, 2014) 1, www.pewinternet.org/files/2014/01/PIP_E-reading_011614.pdf (reporting a Pew study documenting the growth in e-reading); Hannibal Travis, ‘Myths of the Internet as the Death of Old Media’ (2014) 42 American Intellectual Property Law Association Quarterly Journal 1, 8 (“Copies of books sold more than doubled from one billion in 1993 to 2.3 billion in 2007. The number of titles produced increased to more than 70,000 in 2002 and to almost 300,000 in 2012” (footnote omitted)). When we factor in self-published and print-on-demand books, that number rose to “more than three million in 2010.” See also, ibid.


12 Travis (n 9).

13 ibid.
year creating content online for no reason other than to share it with the world. They create and edit Wikipedia pages, post favorite recipes, create guides to TV shows and video games, review stores and restaurants, and post information on any subject you can imagine. If, as Doctor Johnson famously suggested, ‘[n]o man but a blockhead ever wrote except for money,’\textsuperscript{14} we are a world of blockheads, gleefully creating and sharing all sorts of content with the world.

Why are people creating so much content without the incentive of IP rights? And why hasn’t the sky fallen on the content industries? There are at least six reasons. The first is the very reduction in reproduction and distribution cost that created the infringement problem in the first place. Twenty years ago, most of the costs associated with generating content were not from paying artists to create. Indeed, as noted above, artists normally got only a small fraction of the sales price of their work. The Internet makes most of that cost disappear. As a result, content owners can charge a much lower price online and still be profitable. An eBook may retail for quite a bit less than a hardcover book, but it also costs a lot less to produce. Alternatively, content companies may decide (as the music industry has) to jack up their profit margins on digital content by charging the same price online as they would offline. If they do that, they will make fewer sales, but they will make more profit on the sales they do make, since they don’t have to pay much for reproduction and distribution of that content. Companies that take this strategy can remain profitable even with a much higher level of piracy, simply because their costs have declined so dramatically.

Second, many of the same technologies that reduced the cost of reproducing and distributing content also reduced the cost of producing that content. High-quality music recording no longer requires a trip to a sound studio in Hollywood or Nashville; online tools enable emerging artists to produce a professional recording at a fraction of the previous cost. Producing videos is no longer the province of professionals; most people now carry a sophisticated video camera in their pockets, and video production tools enable amateurs to make at least medium-quality video content quickly and cheaply. Digital technologies have similarly reduced the cost and complexity of photography and the ease of generating original content on the web in the form of blogs and other websites. If the cost of creation drops alongside the cost of distribution, IP theory should worry less about the latter.

\textsuperscript{14} R.W. Montagu (ed), \textit{Johnsoniana: Life, Opinions, and Table-Talk of Doctor Johnson} (Alfred Boot 1884) 310.
Third, fewer sales does not mean no sales. One of the lessons of the Internet is that a surprising number of people will pay for content they like even when they don’t have to. While the increased efficiency of the Internet has driven marginal cost towards zero, there are still many purchases of digital content. For example, people made more online music purchases in 2010 than they ever did before the Internet, whether because it is more convenient, because it is legal, or because people actually want to support musicians they like. Indeed, the fact that music is available illegally for free may encourage people to try more music, and many of those people then end up paying for music they like. Even those creators who depend on copyright revenues for incentives don’t need to make money from every copy. A hybrid ecosystem in which sales coexist with piracy may provide sufficient incentive to keep those artists creating, even if they make less money than they would in a world without piracy. Artists are also finding new (or sometimes old) ways to get paid, from musicians touring and selling T-shirts to writers turning to serialized content. And offering content to others for free radically expands the number of consumers of that content by eliminating financial transactions, enhancing social welfare.

Fourth, the combination of reduction in the costs of creation, reproduction, and distribution has opened the doors to numerous new creators who could not find an audience in the pre-Internet world, either because creation was too costly or because they were not identified by the content-distributing intermediaries like record companies, publishing houses, or movie studios. Even if traditional content creators had less incentive to create after the development of the Internet, the Internet enabled the rise of a mass of amateur, semiprofessional, and small-scale professional creators that more than made up the difference. Any decline in professional production has been more than made up for by the entry of new content providers as the cost of photo and video production.
technology dropped precipitously. If the goal of IP is to encourage new creation, the fact that we have opened new avenues to implement and distribute that creativity may serve that goal even as traditional paid content creation jobs decline. When it comes to creation, the evidence suggests that we want many different eyes on a problem, not just a few, no matter how concentrated their incentives.

Fifth, opening the door to new creators by reducing costs and barriers to entry doesn’t just give us the new works those creators make; it may actually encourage creativity by others. A growing body of economic literature finds that spillovers—third-party benefits provided by a work that its creator can’t capture—actually drive further innovation. Being around people with good ideas, whether geographically or in a product space, actually makes it more likely that you will have good ideas of your own. So opening up creativity to newcomers may actually make existing creators more productive.

Finally, it may simply be that IP theory is wrong about what motivates people to create. There is substantial evidence in the innovation and psychology literatures that motivation to create is largely internal or problem driven.17 People create because they have an inspiration, because they are driven to do so, or because they want to solve a problem.18 They seem to be motivated more by rights of attribution and recognition than

17 Orly Lobel, Talent Wants to be Free (Yale University Press 2013) 170–79. For a discussion of the neuroscience of creativity, see generally Oshin Vartania and others (eds), Neuroscience of Creativity (MIT Press 2013); Erez Reuveni, ‘Copyright, Neuroscience, and Creativity’ (2013) 64 Alabama Law Review 735.

by money.\textsuperscript{19} Free riding doesn’t seem to stop them from innovating. Indeed, there is even evidence that monetary incentives can reduce creativity: works created because of a demand or promise of payment are


One might view the idea that creators aren’t primarily motivated by money as a rejection of economics, but I don’t think it is. Economics, properly understood, is about understanding the incentives that motivate human behavior. Sometimes that is money, but not always. Evidence that people are motivated to create by things other than money may mean the classic IP incentive story is wrong, but it doesn’t mean that economics is wrong.

\textsuperscript{19} See Mihaly Csikszentmihalyi, \textit{Creativity: Flow and the Psychology of Discovery and Invention} (Harper Collins 1996) 107–08 (finding that creative people often value enjoying their work more than money); Jessica Silbey, \textit{The Eureka Myth: Creators, Innovators, and Everyday Intellectual Property} (Stanford Law Books 2015) 14 (surveying creators about their motivations); Jeanne C. Fromer, ‘Expressive Incentives in Intellectual Property’ (2012) 98 Virginia Law Review 1745, 1777 (“creators’ beliefs in their moral rights typically seem to dominate their pecuniary interests in creating”); Fromer (n 18) 1483 (noting that people are most creative when intrinsically motivated, although creators require extrinsic support to publicize and distribute their work); William Hubbard, ‘Inventing Norms’ (2011) 44 Connecticut Law Review 369, 369 (stating that inventors are motivated to invent because of societal norms that result in personal satisfaction and esteem from friends for successful invention); Rebecca Tushnet,
less creative than those created for other reasons, because *doing it for the money* seems to dampen intrinsic motivation.\(^{20}\) And the way they create

\(^{20}\) See Teresa M. Amabile, *Creativity in Context* (Westview Press 1996) 171 (noting that research indicates that the offer of rewards undermines creativity); Lobel (n 17) 190–95 (explaining that people are most productive and creative at work when they feel useful and connected to their work and workplace); Beth A. Hennessey & Teresa M. Amabile, ‘Reward, Intrinsic Motivation, and Creativity’ (1998) 53 The American Psychologist 674, 675 (noting that extrinsic motivation can sometimes improve motivation and creativity, but usually only under limited conditions or with specialized training); Mandel, *Promote* (n 18) 2010 ("As motivation moves from the extrinsic toward the intrinsic side of the motivation spectrum, individuals’ work product tends to become more creative"); John Quiggin & Dan Hunter, ‘Money Ruins Everything’ (2008) 30 Hastings Communications and Entertainment Law Journal 203, 214–15 (discussing the role of noncommercial motivations for amateur content creation in the privacy of homes); cf. Yuval Feldman & Orly Lobel, ‘The Incentives Matrix: The Comparative Effectiveness of Rewards, Liabilities, Duties, and Protections for Reporting Illegality’ (2010) 88 Texas Law Review 1151 (discussing the efficacy of monetary incentives in a non-IP context). For an empirical test of this question, see Christopher Buccafusco and others, ‘Experimental Tests of Intellectual Property Laws’ Creativity Thresholds’ (2014) 92 Texas Law Review 1921, 1972–73 (finding that high creativity thresholds for monetary rewards did not impede creativity and may have enhanced it).

There is another factor at work here: people in any occupation traditionally work less as they are paid more because they substitute leisure time for additional money. Economists call this the “income effect.” ‘Nice Work if You Can Get Out’ (*Economist*, Apr 19, 2014) 71, www.economist.com/news/finance-and-economics/21600989-why-rich-now-have-less-leisure-poor-nice-work-if-you-can-get-out. That is true of creators as well as other kinds of employees. Thus, Mike Scherer finds that Italian composer Giuseppe Verdi substantially reduced the number of operas he wrote each decade once copyright was introduced in Italy and his earnings increased. F.M. Scherer, ‘The Emergence of Musical Copyright in Europe from 1709 to 1850’ (2008) 5 Review of Economic Research on Copyright Issues 3, 11. Lunney makes this point more general: beyond a certain point, artists will create less as they are paid more. Glynn S. Lunney, Jr., ‘Copyright’s Mercantilist Turn: Do We Need More Copyright or Less?’ Tulane University School of Law, Public Law & Legal Theory Working Paper Series, Working Paper No. 12-20 (2012) 16–18, http://ssrn.com/abstract=2158874. That is particularly true with copyright, which provides a continuing revenue stream for past works rather than conditioning payment on future creativity.

Interestingly, however, one corollary of the income effect—that rich people should enjoy more leisure time than poor people—has recently stopped being true. See above ‘Nice Work’ (*Economist*) (reporting evidence on this “substitution effect”). I discuss some of the implications of that fact in Section 4.
seems to rely on networks of people and information that creators draw on as inputs. Collaboration may be inherently more productive than isolated work. If this is true, the Internet may have spurred an unprecedented outpouring of creativity for the simple reason that many people are now free to create and share their works with the world for the first time. More input plus more minds at work means more creative works.

This last hypothesis, if true, does not mean that IP never played a role in the creative process, or that it cannot continue to do so in some ways. It may be that even if artists and inventors are not primarily motivated by money, corporations are. Those corporations might pay the artists and inventors to create, or acquire their work and do the costly job of bringing it to the masses. A number of scholars have suggested that what IP truly encourages is not the act of creation but the act of commercialization. I have elsewhere been critical of the idea that we should give one company control over investing in bringing a product to market. And the empirical evidence suggests that IP rights actually impede rather than encourage commercialization. But even those who believe that IP law traditionally served the goal not of encouraging creation but of encouraging its distribution should acknowledge that the Internet renders that justification irrelevant. An IP regime based on the idea that reproduction and distribution are costly and need to be encouraged becomes unnecessary in a world where reproduction and distribution become costless.

There is still a role for IP on the Internet. There are some works that are so costly to create even in the digital world that they are unlikely to be made without effective IP protection. Big-budget movies and video games cost hundreds of millions of dollars to make. No amount of creative fire will drive someone who doesn’t have hundreds of millions of dollars to make Peter Jackson’s Lord of the Rings trilogy. They need corporate backing, and the corporate backers need a revenue stream. But in the Internet era those works are increasingly the exception, not the rule. The law therefore needs to figure out ways to protect those exceptional works without blocking the creativity that is happening despite, not because of, IP.

3.2 Lessons from the Internet Experience

The Internet offers valuable lessons for the coming economy of plenty. In a world where goods, services, and biologics share the economic characteristics of content distributed over the Internet, what can we learn about IP and innovation in those spaces? Here are several lessons.
3.2.1 IP owners will fight the death of scarcity

Content owners fought tooth and nail to prevent the development of digital content. They sought to shut down the technology, to sue the people who used it, and to sue anyone associated with those people. Ironically, at least one reason that copyright infringement is so prevalent on the Internet is that, for many years, consumers who wanted access to digital content on demand had no legal alternative. The music industry spent years trying to shut down digital music before actually offering a realistic, legal, digital music service, and when they finally did agree to license a legal alternative—iTunes—they priced their songs to protect their offline music market rather than to make digital music attractive. Book publishers conspired to raise the price of eBooks so they wouldn’t cut into the sales of hardback books; it took a successful government antitrust case to force competition in eBook pricing. And even today, the labyrinth of rules around lawful access to television shows is so great that it is impossible to know what episodes of a show will be available when, from what source, and for how long.

Some of that resistance is irrational, a fear that the sky is falling whenever things change. But some of it is rational even if it is not socially optimal. While I suggest society would benefit from the explosion of content on the Internet, and I think that on balance creators would too, it does not follow that existing copyright industries will benefit. The history of technological disruption of copyright law is almost always one of more people creating more content and making more money, but the people making money from content in the new regime are not always the same ones who made money in the old one. The phonograph was a godsend to both musicians and consumers, but those in the business of printing sheet music probably didn’t see it that way. Similarly, while record companies, movie studios, and book publishers will all likely survive the digital transition, it is doubtful they will be able to hold on to a business model in which they take the lion’s share of the revenue, leaving only a small percentage for the artists. It may well be rational for record companies and movie studios to fight the digital transition, even if it is rational for everyone else concerned to hope they lose that fight.

The same dynamic is likely to play out with 3D printing. Professional industrial design firms will resist 3D printing because they fear losing control over who can use their design and not getting paid when people do. We should expect to hear the same sorts of warnings about these new technologies that we heard about the Internet, and we should expect to see the same effort to use IP rights and the courts to bring those technologies under control.
3.2.2 IP owners will (probably) lose that fight

IP owners lost the fight to keep content off the Internet, or alternatively to lock down the Internet itself, for two reasons. First, there was simply too much value to the Internet as a whole and the digital distribution of content. Courts were willing to shut down sites like Napster, Grokster, and others that they viewed as designed entirely to profit from copyright infringement, but they have so far balked at IP owner requests to ban sites like Amazon, Google, or YouTube that clearly had large social value despite also facilitating some infringement. The second reason has to do with the democratizing nature of the Internet. There is no central infringer on the Internet. When centralized nodes for specialized services did appear, like Napster, courts promptly shut them down. But because there was so much demand for content online, even when sites were shut down, others promptly took their place. And those sites became more and more decentralized, and correspondingly harder and harder to shut down. IP owners were reduced to playing Whac-a-Mole with infringing sites.

The same dynamic is likely to unfold with 3D printing. We have already seen calls to ban content on 3D printers—not because of IP infringement, but because people have distributed blueprints for 3D printing plastic guns that can bypass traditional airport security. But precisely because the blueprint for the 3D-printed gun is nothing more than information, it turns out to be extremely hard to suppress it.

IP owners in each of those industries may well turn, as the content industries did, to an effort to shut down or regulate the new technology altogether. Lawmakers frustrated by 3D-printed guns have already begun to talk about regulating the sale of 3D printers themselves, just as copyright owners have sought to regulate Internet connections and search engines. It is easy to imagine legislators similarly seeking to regulate gene printers in an effort to stop smallpox or to regulate unauthorized modifications to robots that might invade privacy or carry weapons.

I believe—and hope—that those efforts will fail, for the simple reason that the potential social value in these new technologies, like the Internet, is enormous. But that outcome is not certain. It depends on how established the technologies are when IP owners and others try to ban them, how clear the benefits of those technologies have become, and the farsightedness of courts and legislators asked to restrain innovation in order to protect incumbent businesses.

It also depends on the particular characteristics of the IP regimes affected. Fairly early on in the growth of the Internet, copyright law built in a limited immunity for intermediaries that allowed the development of distribution technologies like YouTube. But the IP laws that will apply to 3D printers, synthetic biology, and robotics are not just copyright but also...
utility patent and design patent law, which have characteristics that are much less hospitable to intermediaries.

Utility patent and design patent law do not require copying; independent creation of the same technology is an act of infringement. And while they were written with manufacturing entities in mind, anyone who makes or uses the invention is an infringer, creating a risk that end-users will be sued for patent infringement when they use 3D printers. There is as yet no immunity for intermediaries from utility patent or design patent infringement. On the other hand, copyright law is more easily adapted to information; depending on the way the claims are written, owners of utility or design patents might have to sue the actual maker of a thing rather than just the intermediary who provides a blueprint.

The Internet has survived repeated efforts by private parties to lock it down. But that was never a guaranteed outcome. One possible future for 3D printing is a dystopian one in which a few large companies get the right to decide what sorts of innovation are permissible, whether by combining existing law with ubiquitous surveillance technology or by passing new laws that restrict entry into the technology.

3.2.3 IP owners’ loss is (mostly) innovation’s success
If we can avoid the dystopian future of lockdown, the future of technology is likely to look quite a bit like the Internet. Lots of people will create lots of designs. Other people will use, repurpose, and improve on those things, often without paying. But people will continue to create, because some people will pay for their creations, because there will be other ways to make money from being creative, because they want to be known for something or want the feeling of accomplishment that comes with creating, and, ultimately, simply because they can. More and more of these creations will operate outside the IP system, either expressly or by the simple virtue of ignoring that system.

This future is not a utopia. 3D printing requires physical inputs that will in turn be subject to the laws of scarcity. Further, the lesson of the Internet is that while cheap, democratized production drives more creation, not less, it may also change the nature of that creation. Without IP rights we may see more creation by amateurs and academics and less by professional creators, just as in music we now see more new bands and fewer bands with multi-album staying power. That is both a good and a bad thing; removing the requirement of a major-label record contract has let lots of new talent into music, but the decline of professional artists may change the nature of music in ways that cause us to lose some music we’d like to have. Similarly, it is possible to imagine both a wealth of
new product designs for 3D printers and a decline in the number of professional design firms.

At least in the medium term, however, those professional firms are likely to coexist with the amateurs, just as professional musicians and movie studios have found it possible to coexist—even thrive—alongside the new entrants. The dramatic reduction in cost that has spurred new entry also boosted the demand for content, and people are willing to pay for things they like if they are delivered in convenient packages. And IP rights are unlikely to disappear even if they are increasingly flouted, so professional providers who choose to rely on IP rather than sharing their work for free can still make some money by doing so. The IP laws will continue to exist, and they will provide a necessary incentive for some forms of creativity. But creation that relies on IP is likely to play a less and less significant role in a post-scarcity world.

4. BEYOND THE ECONOMICS OF SCARCITY

As we saw in Section 3, IP law has significant implications for the development of a number of different technologies. But those technologies also have broader implications for IP law, and indeed for the economy more generally.

4.1 IP in a Post-Scarcity World

I suggested in Section 3 that on the Internet, we increasingly get creativity in spite of, rather than because of, IP law. If true, that fact has important implications for the role of IP. We are still a long way from a post-scarcity world. But as more and more pieces of the economy are based on information coupled with cheap, decentralized supplies of physical goods, our IP rules will take on increasing importance. The point of the IP laws is to encourage creation. If those laws are not promoting innovation and creation in that new world, we need to rethink them.

The IP laws were created in a world of scarcity. They sought to take ideas that were public goods—things that by their nature were not scarce—and artificially make them scarce by designating them as owned by someone. The hope was that by bringing those ideas within the traditional framework of economics, we would create market incentives we could understand and accordingly encourage investment both in the creation of new things and the distribution of those things to the world. By most accounts, that approach has worked quite well for a long time.
But that doesn’t mean it always will. IP regimes have always coexisted with areas of innovation not protected by IP, governed instead by open competition or informal norms of sharing: food, fashion, comedy, and many others come to mind. And as Jessica Litman has noted, we have seen robust innovation environments develop wherever there are limits or exceptions to copyright law.

Even in domains in which IP offered protection, people have chosen to opt out of that protection or change its rules to suit their needs. The Internet is one such domain; most of the work created for the Internet is nominally copyrighted but, in practice, subject to norms of non-enforcement under a wide range of conditions. It may be that we simply do not need IP protection when both the cost of creation and the cost of distribution fall below a certain point. If I am right about the trajectory of the technologies I have discussed here, more and more pieces of the economy will fall below that threshold.

That doesn’t mean IP can or will disappear, and certainly not overnight. It simply means that how much (if any) IP we need in a given industry is a function of the characteristics of that industry. As those characteristics change, so must IP. There are some industries, like pharmaceuticals, that will need strong IP protection for the foreseeable future to encourage innovation despite the cost of government regulatory barriers. Even in industries that lack those barriers, there may be technologies or creative works (like big-budget movies and video games) that cost so much to develop that no one will invest in them without IP protection. Further, the technologies I have described won’t eliminate all scarcity, and certainly not right away. Rather, market disruption will come in fits and starts as technologies develop and are deployed at differing rates. But in a post-scarcity world, high-cost products will increasingly become the exception, not the norm. They will be islands of IP-driven content in a sea of content created without the need for IP.

IP is essentially a form of government regulation. The government restricts entry into the market, or alternatively controls the price at which that entry can occur, in order to serve valuable social ends. But regulation is not a moral entitlement or something that we must take for granted. In the past, the government regulated all sorts of industries—railroads, trucking, electric power, gas, telephones—because it could not see, given the economics of those industries, how a free market could produce socially optimal results. But in a surprising number of cases, when we deregulated those industries we found that the market could indeed find a way to supply goods we thought would be provided only with government rulemaking. IP is no different in this respect than any other form of regulation. Regulation as a whole shouldn’t disappear, but regulation of
particular industries often turns out to be a reflexive response to a failure of imagination, something we do because we have done it for so long that we cannot imagine how a market in that industry could function without it.

We must similarly be willing to question IP in a post-scarcity economy. Changing economic characteristics may undermine the theoretical basis for IP. IP will continue to exist in a post-scarcity economy, but it is likely to recede in importance as a driver of creation.

The Internet experience offers some guidance in making laws for this new world. First, we should resist the tendency to expand IP reflexively to meet every new technological challenge. Incumbent industries are always threatened by new technologies and they often turn to regulation to create barriers to those technologies in order to protect the old way of doing things. IP owners will do the same thing. Trademark owners used to a world in which only commercial counterfeiters reproduce their brands will struggle with how to adapt trademark law to private home generation of logoed products. But it is not clear that they should have a right to prevent the mere making of a thing that looks like a trademark when it is not sold in commerce. Copyright owners will struggle with how to protect files that are effectively only blueprints for the making of a useful article.

Second, IP owners should not be allowed to reach beyond suing infringers to shut down or modify the technology itself. The temptation for them to do so is powerful, and will only grow as new technologies democratize the acts of reproduction and distribution. But blocking technological development in order to protect IP rights is likely to do far more damage than good to the economy.

IP laws should be reformed to give more breathing room to new technologies, even if those technologies can be misused for infringement. We may well need a form of legal immunity for the designers of the hardware for 3D printers just as we do for providers of general-purpose computers or Internet service providers. We may also need immunity for those who host the information content that runs on that hardware. Like those technologies, the makers of 3D printers are building a substrate divorced from the informational content of the design, and hence from the uses to which the device might be put.

Finally, IP law needs to make it easier for creators to opt out of the IP regime. The Internet is littered with unnecessary copyrights automatically given to works that have no need for them. While there are ways to release an idea to the public irrevocably, they are complex and seldom used. It is easier not to obtain a patent or a design patent, but simply opting not to do so will not protect an inventor from being sued for
sharing her own invention with the world. As a result, even inventors with no interest in asserting IP rights often feel the need to obtain their own for defensive purposes. IP law needs to protect inventors, not just by offering them exclusive rights, but by shielding them from exclusive rights claimed by others.

5. CONCLUSION

The Internet is a harbinger of things to come—of a raft of new technologies that offer the promise of separating creativity from production and distribution, and reducing the cost of all three. Those technologies challenge the basis for our IP system, and indeed the basis for our economy as a whole. The lessons from the Internet experience are surprising and encouraging: people will create when given the opportunity to do so, even without effective IP protection. Those lessons will have relevance for patent and design patent as well as copyright as post-scarcity technologies remake more and more of our economy in the shape of the Internet.