Chapter 5

The Old Technology and Inequality Scam: The Story of Patents and Copyrights

One of the amazing lines often repeated by people in policy debates is that, as a result of technology, we are seeing income redistributed from people who work for a living to the people who own the technology. While the redistribution part of the story may be mostly true, the problem is that the technology does not determine who "owns" the technology. The people who write the laws determine who owns the technology.

Specifically, patents and copyrights give their holders monopolies on technology or creative work for their duration. If we are concerned that money is going from ordinary workers to people who hold patents and copyrights, then one policy we may want to consider is shortening and weakening these monopolies. But policy has gone sharply in the opposite direction over the last four decades, as a wide variety of measures have been put into law that make these protections longer and stronger. Thus, the redistribution from people who work to people who own the technology should not be surprising — that was the purpose of the policy.

If stronger rules on patents and copyrights produced economic dividends in the form of more innovation and more creative output, then this upward redistribution might be justified. But the evidence doesn't indicate there has been any noticeable growth dividend associated with this upward redistribution. In fact, stronger patent protection seems to be associated with slower growth.

Before directly considering the case, it is worth thinking for a minute about what the world might look like if we had alternative mechanisms to patents and copyrights, so that the items now subject to these monopolies could be sold in a free market just like paper cups and shovels.

The biggest impact would be in prescription drugs. The breakthrough drugs for cancer, hepatitis C, and other diseases, which now sell for tens or hundreds of thousands of dollars annually, would instead sell for a few hundred dollars. No one would have to struggle to get their insurer to pay for drugs or scrape together the money from friends and family. Almost every drug would be well within an affordable price range for a middle-class family, and covering the cost for poorer families could be easily managed by governments and aid agencies.

The same would be the case with various medical tests and treatments. Doctors would not have to struggle with a decision about whether to prescribe an expensive scan, which might be the best way to detect a cancerous growth or other health issue, or to rely on cheaper but less reliable technology. In the absence of patent protection even the most cutting edge scans would be reasonably priced.

Health care is not the only area that would be transformed by a free market in technology and creative work. Imagine that all the textbooks needed by college students could be downloaded at no cost over the web and printed out for the price of the paper. Suppose that a vast amount of new books, recorded music, and movies was freely available on the web.

People or companies who create and innovate deserve to be compensated, but there is little reason to believe that the current system of patent and copyright monopolies is the best way to support their work. It's not surprising that the people who benefit from the current system are

reluctant to have the efficiency of patents and copyrights become a topic for public debate, but those who are serious about inequality have no choice. These forms of property claims have been important drivers of inequality in the last four decades.

The explicit assumption behind the steps over the last four decades to increase the strength and duration of patent and copyright protection is that the higher prices resulting from increased protection will be more than offset by an increased incentive for innovation and creative work. Patent and copyright protection should be understood as being like very large tariffs. These protections can often the raise the price of protected items by several multiples of the free market price, making them comparable to tariffs of several hundred or even several thousand percent. The resulting economic distortions are comparable to what they would be if we imposed tariffs of this magnitude.

The justification for granting these monopoly protections is that the increased innovation and creative work that is produced as a result of these incentives exceeds the economic costs from patent and copyright monopolies. However, there is remarkably little evidence to support this assumption. While the cost of patent and copyright protection in higher prices is apparent, even if not well-measured, there is little evidence of a substantial payoff in the form of a more rapid pace of innovation or more and better creative work.

Stronger and longer: The path of patent and copyright protection since 1970

In recent decades, both political parties have been largely supportive of measures to increase the length of patent and copyright protection, increase the scope of these protections, increase penalties for violations of the law, and extend protections internationally through trade agreements and political pressure. As a result, protections in both areas are far stronger in 2016 than in prior decades, and a much broader set of products are subject to protection.

Prior to 1995, patents in the United States extended for 17 years after the date of issuance. In that year, Congress passed and the president

signed legislation changing the length to 20 years from the date of filing to be in compliance with the TRIPS (Trade Related Aspects of Intellectual Property Rights) provisions of the Uruguay Round of the WTO (USPTO 2015). This law also included provisions allowing for the extension of the duration of patents in the event the approval process took more than three years, the average length of the process. Patents issued prior to 1995 were extended to 20 years from filing or 17 years from issuance, whichever was longer. In 2015 the duration of design patents — those that apply to the design of a product like furniture or appliances — was extended from 14 years to 15 years from the date of issuance (U.S. Government Publishing Office 2012).

Prior to 1976, copyrights lasted 28 years from the date they were secured, with the possibility of an extension for another 28 years (U.S. Copyright Office 2011). The 1976 Copyright Act increased the length of the extension to 47 years, for a total possible duration of 75 years, and the 1998 Copyright Term Extension Act increased it to 67 years, for a total possible duration of 95 years. In both cases, the extensions were applied retroactively to works whose copyright was still in effect. In 1992, Congress made renewal of copyrights automatic for works copyrighted after 1964. This is noteworthy because in the United States copyright holders do not have to formally register, a change introduced in the 1976 law. As a result, it can be difficult and time-consuming for someone seeking to make use of copyrighted material to track down the copyright holder. In fact, in many cases potential users would have no way of knowing the material was copyrighted. Legislation in the 1990s extended copyrights further to 95 years.

In addition to duration, the scope of patent and copyright protection has been expanded as well. In the 1980s, patents were extended to cover DNA sequences and life forms, and in the 1990s it became possible to patent software and business methods. The Bayh-Dole Act of 1980 allowed for universities, research institutions, private companies, and individuals operating on government contracts to gain control of patents derived from their work, thereby creating the opportunity for universities to earn large rents from patents and for researchers to form their own companies, all relying on knowledge and

expertise obtained on government contracts. In 1982, Congress created a designated court to hear patent appeals cases, the U.S. Court of Appeals for the Federal Circuit, and it has been substantially more patent friendly than prior appellate court panels. In cases where a patent's validity was in question, the new court has ruled in favor of the patent holder in two-thirds of cases, compared to one-third of cases in prior appellate courts (Scherer 2009).

The scope of copyright protection has been extended to accommodate digital technology. The most important development in this area was the Digital Millennial Copyright Act of 1998 (DMCA), which applied explicit rules for digital reproduction and transmission of copyrighted work. The act allows for large fines and extensive prison sentences for willful violations (U.S. Copyright Office 1998). While it is reasonable to have rules for digital reproductions, the act was in effect a decision to preserve a form of publication rather than allow it to fall victim to changing technology (Kodak film wasn't so lucky). Even with the passage of the DMCA, the entertainment industry remains unhappy with the extent to which copyrighted material is reproduced without authorization. It has repeatedly sought measures in Congress, such as the Stop Online Piracy Act (SOPA) and the PROTECT IP Act (PIPA), and in trade agreements to strengthen copyright enforcement. These measures would require Internet intermediaries like Google, Facebook, and millions of smaller sites to proactively police postings by third parties to prevent copyright violations. These rules would shift the responsibility and cost of enforcement from the copyright holder to someone else.

As technology increases the ease of reproducing and transferring copyrighted material, copyright enforcement becomes more costly and difficult. Efforts to continue enforcement inevitably impose greater costs on society.

Administrations of both political parties have placed a high priority on extending patent and copyright protection to other countries through trade agreements and political pressure. The most important item in this area was the inclusion in the WTO of TRIPS, which required developing countries to adopt U.S.-style patent and copyright laws, albeit with a substantial phase-in period (which has been repeatedly extended)

for the poorest countries. Other trade deals, like the North American Free Trade Agreement, the Central America Free Trade Agreement, and the Trans-Pacific Partnership, have included "TRIPS-plus" provisions such as data exclusivity, which prohibits generic drug manufacturers from using test data submitted by brand manufacturers to establish the safety and effectiveness of their drugs, and marketing exclusivity, which prohibits generic competitors from competing during the period of exclusivity even if they conducted their own clinical trials. These treaties have also broadened the scope of patentable items; for example, the Trans-Pacific Partnership requires patents be issued for new uses of existing compounds and for combination drugs (many widely used new drugs involve new combinations of existing molecules, rather than the development of a new chemical entity).

The United States has also pursued stronger and longer patent and copyright protections in bilateral negotiations. For example, the Obama administration has been quite public about its efforts to force the Indian government to allow patents for combination drugs. It also has sought to discourage countries from exercising their right to require compulsory licenses for drugs, as explicitly allowed under the TRIPS provisions.

Stronger patent protections in developing countries serve two purposes. The first is the obvious one of increasing the profits of drug companies. But the industry also is concerned about the large gap between the price of patent-protected brand drugs in the United States and their generic equivalents in developing countries. For example, the hepatitis C drug Sovaldi has a U.S. list price of $84,000 for a three-month course of treatment, while in India high-quality generic versions are available for $300 to $500 (Gokhale 2015). For new cancer drugs selling for over $100,000 per year, the gap with generic prices could be even larger. These enormous differences create a large incentive for patients to seek out the generic version, whether by finding a way to bring the drugs into the United States or by traveling to a country where the generic is

available.[36] If the pharmaceutical industry can succeed in taking away the generic option, it will eliminate a major threat to its marketing model.

In short, we have seen considerable strengthening of intellectual property rules in the last four decades, as summarized in **Table 5-1**. The result has been a sharp increase in the size of rents for the protected items, most notably prescription drugs and medical equipment, which grew from 0.4 percent and 0.17 percent of GDP in 1975, respectively, to 2.3 percent and 0.51 percent in 2015. (In the 2016 economy, these increases would be equal to $350 billion and $63 billion, respectively.) The increase in the economic importance of patents also led to a sharp increase in patenting and in patent suits, as the growing value of these rents provided more incentive to companies and individuals to pursue and contest patents. These costs would be justified if the incentives also led to more innovation and creative work, but it is questionable that this has been the outcome.

Before examining some of the recent literature in this area, it is worth describing the nature of the possible rents in patent and copyright. With both, the government grants individuals or corporations a monopoly for a period of time as an incentive to innovate or produce creative work. The question of rents comes up in the context of whether such monopolies are the most efficient way to provide incentives and whether the system as currently structured is optimal. The rents would be the additional cost that society incurs as a result of this system being less than optimal. As the literature shows, this question does not have a simple answer because it can't be known whether alternative mechanisms will be as effective in promoting innovation and creative work. However, it is possible to get good estimates of the extent to which these monopolies compared with a competitive market raise costs. And there is some basis for assessing the

36 Pharmaceutical companies have sought to place extraordinary restrictions on the use of low-cost drugs in developing countries. For example, Gilead Sciences, the patent holder on Sovaldi, authorized a generic version for Egypt. However, a condition of this license is that the government carefully police the distribution of the generic. Patients are supposed to pick up the drug themselves, and open the container and take the first pill in the presence of the pharmacist selling the drug. See McNeil (2015).

efficiency of alternative funding mechanisms for innovation and creative work. These calculations can provide a basis for assessing whether alternative mechanisms are likely to be more efficient.

TABLE 5-1

Legal changes affecting patents and copyrights since 1970

Year	Change
1976	Copyright duration extended to 75 years from 58 years (applied retroactively). End of registration requirement for copyright protection.
1980	Bayh-Dole Act allows universities, research institutions, private companies, and individuals operating on government contracts to gain control of patents derived from their work.
1980	In Diamond v. Chakrabarty, Supreme Court rules that life forms are patentable.
1981	In Diamond v. Diehr, Supreme Court sets rules under which computer software can be patented, formalized by U.S. Patent and Trademark Office in 1996.
1982	Congress creates the United States Court of Appeals for the Federal Circuit to handle patent claims, a court that proves to be more patent-friendly.
1995	TRIPS provisions of the WTO require member countries to adopt U.S.-style patent law. Congress extends duration to 20 years from date of issuance, with automatic extensions in cases where approval process was delayed.
1998	Copyright duration extended to 95 years (applied retroactively).
1998	Digital Millennial Copyright Act extends copyright to digital materials. Also establishes liability for third-party intermediaries.
1998	In State Street Bank & Trust Co. v. Signature Financial Group Inc., Supreme Court rules that business methods are patentable.
2006	Central America and Dominican Republic Free Trade Agreement and Dominican Republic — includes "TRIPS Plus" provisions requiring countries to have lengthy periods of data exclusivity when a drug is approved by licensing authority. This excludes generics from the market even when no patents are applicable.

Source and notes: Various sources, see text.

Rents from patents and copyrights: What the literature shows

There is a vast literature on the benefits and the costs of patent and copyright protection. The case against such protections is best summarized in a series of works authored or co-authored by David Levine and Michele Boldrin. They note that the number of patent approvals more

than quadrupled between 1983 and 2010 with no obvious benefits in terms of either expenditures on research and development (R&D) or total factor productivity growth. R&D expenditures have been near 2.5 percent of GDP since the 1970s, with no upward trend associated with the proliferation of patents. The same is the case with total factor productivity growth. It averaged 1.2 percent from 1970–1979, while falling below 1.0 percent in the decade from 2000–2009. (It has been even lower in the last six years.) Their work also includes more detailed analyses of multifactor productivity growth by sector. They find little relationship between the number of patents in a sector and the rate of productivity growth (Boldrin et al. 2011). The fit is not improved when measures like frequency of patent citations are used instead of the number of patents. In short, they find little evidence in this work of the positive benefits of patents.

These findings are consistent with a series of cross-country regressions testing whether GDP growth or productivity growth, by a variety of measures, is increased as a result of stronger patent protection (Baker 2016). The overwhelming majority of tests find no evidence of a positive relationship. In fact, in many of the specifications there is a statistically significant negative relationship, implying that stronger patent protection is associated with slower productivity growth. While these tests are far from conclusive, the implication is that the additional waste associated with stronger patent monopolies more than offsets any benefits from incentivizing innovation.

Levine and Boldrin cite a range of evidence that patents can be a major source of waste and a hindrance to productivity growth. For example, the vast majority of patents are never used, and old, established companies often stockpile them to use as competitive weapons against smaller upstarts. Examining the upsurge of patents in the semiconductor industry in the 1980s and 1990s, Hall and Ziedonas (2001) found that the main motivation was to use patents as weapons in lawsuits against competitors and as bargaining chips in the settlement of cases. Because litigation involves large costs, an established firm is much better situated to contest a patent than an upstart with few resources. As a result, a patent can be used to force the upstart to share much of the benefits of its

technology, even if there is no actual dependence on the patent of the established firm.

This sort of reasoning was widely cited as the main explanation for Google's decision to buy the Mobility division of Motorola in 2011 for $12.5 billion. At the time, as a relatively new company, Google did not have a large portfolio of patents that could be used as retaliatory weapons if it were sued. The purchase of Mobility gave Google a large portfolio.

The extreme example of using patents for legal harassment is that of a patent troll, a company that exists only to push claims of patent rights against profitable companies. Boldrin and Levine (2013) note the case of NTP Inc., a patent holding company that won a patent infringement case against Research in Motion (RIM) over the Blackberry. In order to avoid having its system shut down at a point where its service was expanding rapidly, RIM agreed to pay NTP $612.5 million to license the use of the patent. On appeal, the original ruling was overturned, but RIM did not get its money back. The implication is that more than $600 million was taken from what at the time was a thriving and innovative company, due to a mistaken judicial ruling. Of course, this ruling provided an enormous incentive for other companies to follow NTP's example.

A study by Bessen and Meurer (2012), which relied on a survey of corporate executives, put the direct cost to firms of litigation with patent trolls (including settlements) at $29 billion in 2011. An earlier study involving the same authors looked at the impact on stock prices and put the cost at $80 billion a year (Bessen et al. 2012). Most of the cost in these estimates stems from payments made to the patent trolls or the need to alter a business plan in response to a patent suit. Insofar as these payments reflect compensation for legitimate innovations (a claim disputed by Bessen and Meurer), they would not constitute rents associated with the patent system; they would simply be redistributions among patent holders. But even with this generous interpretation, Bessen and Meurer still attribute more than $5 billion of their $29 billion estimate to direct litigation costs.

These litigation costs are pure waste from an economic standpoint, and the actual waste to the economy would have to be several times this size, because the patent trolls undoubtedly spent a comparable

amount on litigation. In addition, this study is only looking at suits with patent trolls (formally, non-practicing entities (NPEs)), which account for roughly 60 percent of all patent suits. While suits brought by companies that actually use the technology may be more meritorious on average, the legal expenses are still a cost to the economy. Extrapolating from the $5 billion estimate of litigation costs, total litigation costs related to patents for 2011 could have easily been close to $17 billion, or 7.3 percent of total R&D spending for the year.[37] And this does not even account for the extent to which payments resulting from these suits may not be merited, as was the case with the NTP suit and which Bessen and Meurer argue is the case with most suits involving NPEs.

Boldrin and Levine (2013) also note the substantial legal costs associated with patent protection. Almost 250,000 patents were filed in 2010, at an average legal cost of more than $7,000 per patent, implying spending of $2 billion in legal fees in 2010 just to file patents. Furthermore, with the ratio of litigation to patents remaining roughly constant while the ratio of patents to R&D spending has risen considerably over the last three decades, the ratio of litigation to R&D spending has clearly increased. From the standpoint of the economy, these additional legal costs are a pure deadweight loss.

The legal issues surrounding the proliferation of patents can obstruct innovation in a variety of ways. Shapiro (2001) notes the problem of "patent thickets," situations where innovations often involve the use of a large set of patents. Patent thickets can result in large transaction costs, which may stifle innovation, and the problem can be even more serious if inadvertent infringement results in penalties. The paper notes that the problem of patent thickets has become especially serious in important sectors like semiconductors, biotechnology, computer software, and the Internet, since all have experienced a proliferation of patents in recent years. In the same vein, patents on research tools, such as transgenic animals and biological receptors, have become increasingly common in the

37 This calculation assumes that the patent trolls' litigation costs are equal to the defendants' ($5 billion). It then assumes that the $10 billion in litigation costs involving trolls accounts for 60 percent of total litigation costs.

last three decades. The royalty payments and transaction costs associated with these tools can make the research to develop new drugs and medical diagnostic products considerably more expensive and thereby slow the process.

Recent research has also found considerable evidence that the threat of patent litigation distorts the direction of research and is a powerful weapon of larger firms against smaller firms and start-ups. Examining the patenting behavior of biotech firms, Lerner (1995) found that firms facing higher legal costs, due to their small size, are less likely to patent in subclasses where there are many other patents. This is especially likely if the firms holding the other patents in the subclass are larger firms with substantial legal resources.

Lanjouw and Schankerman (2001a) found evidence of a strong reputation effect in which patent holders are more likely to file suits in areas where many new patents are being issued. The motivation may be that companies want to show their willingness to contest patents to intimidate competitors. Suits were also more likely if the patent had fewer backward citations. The study takes this as evidence that in new areas where the bounds of existing patents are less well established there will be a larger basis for contesting claims.

Both of these findings are troubling from the standpoint of promoting innovation. Insofar as a reputation effect is important for protecting a claim, it means that larger firms will be better situated than smaller ones that may have difficulty covering litigation costs. The finding that patent suits are more likely in new areas implies that litigation will more frequently be needed to protect patents that are opening new ground, and that patents will be of less value to smaller upstarts than to well-established firms.

Lanjouw and Schankerman (2001b) found that smaller firms and individual patent holders are far more likely to be involved in patent suits than large firms. The disproportionate negative effect on start-ups is made worse by the fact that large patent portfolios seem to provide protection from suits. Firms with large patent portfolios are less likely to be involved in patent suits even when controlling for the size of the firm itself. The conclusion of this analysis is that litigation costs are greater to smaller

firms because they are less well situated to pursue litigation avoidance strategies. Patents are thus a less valuable asset to smaller firms because they are more costly on average for smaller firms to enforce.

Lanjouw and Lerner (2001) found that larger firms were 16 to 25 percent more likely to gain a preliminary injunction in a patent suit than smaller firms. This figure likely understates the bias in favor of large firms because lower litigation costs would mean that they would be more likely to pursue weak patent claims than smaller firms. The advantage indicates a substantial tilting toward large firms, because a preliminary injunction allows the patent holder to effectively maintain a monopoly in the market for the duration of the injunction and prevents the defendant from receiving a return on its investment.

There has been considerable study on the importance of patents as a subsidy for research. Most of the studies find that in most areas the subsidy provided by patents is in the range of 5 to 15 percent of expenditures on research (e.g., Jaffe 2000, Schankerman and Pakes 1986, Lanjouw 1998, and Schankerman 1998). The major exception is in pharmaceuticals, where the subsidy could be 30 percent. These studies find a tremendous skewing of patents, with a relatively small share accounting for the vast majority of the value. Also, the value of most patents seems to dissipate quickly. In several European countries in the 1970s and 1980s, patents were subject to renewal after five years; that the vast majority were not renewed suggests that companies usually did not consider the process worth the fees and associated expenses.

Cohen at al. (2000) surveyed a large number of R&D labs in the United States to gain insights into the relative importance of patents as a mechanism to support research. The study found that patents were viewed as a relatively unimportant mechanism in allowing firms to profit from their research. The respondents cited lead time advantages, secrecy, and the use of complementary manufacturing and marketing as more important than patents. The survey also found substantial differences in answers by firm size, with large firms most frequently citing patents as a major way to protect their investment in R&D.

Patents can raise the cost of R&D by making the use of research tools costly. This is a growing problem in areas like biotechnology, where

many of the tests, tools, and biological materials used by researchers are themselves subject to patents. The costs stem not only from the compensation paid to patent holders, but also the transaction costs associated with all the necessary agreements. The same sort of problem comes up with the development of new drugs or software, where several patents may be involved in the finished product. The innovator must then negotiate with a number of patent holders in order to market its product. This process may prevent many products from ever being marketing. In cases where firms opt for joint licensing agreements, Lerner and Merges (1998) find that the larger firm is most likely left in control of the marketing, leaving the newer firm less likely to reap the full benefit of the innovation.

There is also evidence that the publication of patents does not serve the intended purpose of diffusing knowledge. Boldrin and Levine (2013) argue that firms deliberately write up their patents in ways that make them as unintelligible as possible precisely to avoid giving their competitors any advantage. This practice is certainly what would be predicted as profit-maximizing behavior. As a practical matter, there is no real downside for a firm to write its patent in a way that makes it difficult to understand — it's unlikely that a patent will be rejected for poor writing. In addition, competitors often deliberately avoid having their researchers review patents in order to protect themselves from infringement suits (Gallini 2002). For these reasons, the publication of patents under current intellectual property rules may do less for the diffusion of knowledge than would be hoped.

In sum, evidence suggests that patents and their enforcement impose considerable costs on the economy. There are substantial legal expenses associated with patents, as they are increasingly used as weapons in a competitive strategy. They are used more often as a tool to harass competitors than as a tool to protect innovation. The legal expenses are themselves a substantial drain on the economy, but the larger drain is the extent to which the expenses distort the innovation process, causing companies to abandon promising areas of research and instead look for segments of the market where they are less likely to confront a deep-pocketed competitor. This is likely to be an especially serious problem for

smaller companies and start-ups that are less well positioned to engage in costly patent litigation.

The research shows that the effective research subsidy provided by patents in most sectors is limited, usually in the range of 5 to 15 percent of research expenditures. The major exception is with biomedical research, where the subsidy has been estimated at 30 percent. The evidence from this research raises serious questions as to whether patents are a net positive for innovation and productivity growth.

The body of work produced and compiled by Levine and Boldrin and their collaborators presents an impressive list of the problems associated with the patent system. They argue for weakening or eliminating patents in most areas. Assuming that the patent system is not eliminated in its entirety, they argue for tailoring patent length to the specifics of competition in a sector.[38] They note the need for some public mechanism for funding the R&D of pharmaceuticals, because a free market system is unlikely to support the cost of this work.

Turning now to copyright, a review by Handke (2011) of the empirical research on the cost and benefits of the copyright system begins by noting that claims by Intellectual Property Owners Association (the industry trade group) on the importance of copyright to the economy are grossly exaggerated. The industry group estimates the size of the core copyright industries at $890 billion in 2007 (6.4 percent of GDP). However, this is not a measure of the value of copyrights themselves but rather of the size of the industries, like those involving computer software or newspapers, that make substantial use of copyright protection. The group also exaggerates measures of growth by assuming a constant price on products that are in fact rapidly falling in price (e.g., software).

Handke notes that the evidence with copyrights, like the evidence with patents, is ambiguous as to whether they are a net economic positive. It cites examples of creative work, such as open-source software, that does not depend on copyright protection. It also points out that copyrights can

38 This suggestion goes directly counter to the thrust of recent trade agreements, which have sought to create uniformity in patent duration and enforcement across sectors.

impede creative work by raising the cost of using copyrighted material in derivative work. This can be an especially large problem in the case of copyright, because there is no official registry. It is incumbent on the user to first determine if a copyright protects material, to find the person or corporation in possession of the copyright, and then to make arrangements for non-infringing use of the material.

These transaction costs can be prohibitive in the case of limited uses of copyrighted material in books or movies, leading in many cases to a decision to simply avoid using the work in question. This issue has often been a problem for musicians doing live performances. In principle, the venue where the performance is taking place (typically a restaurant or bar) should be paying a licensing fee for use of songs to the relevant licensing organizations. However, many smaller places with only occasional performances may not want to incur this expense. To avoid potential liability on their part, they would have to ask performers not to include copyrighted material in their sets. This could be difficult for singers or musicians who typically use some amount of copyrighted material in a standard set. As a result, these musicians may find themselves excluded from some of the venues that would otherwise be available to them. Because the vast majority of performing artists will receive far more money from live performances than the sale of recorded music, copyright is more likely to be a hindrance than a support to their work.[39]

This can also be a problem for someone interested in using dated material that could still be subject to copyright protection in a book or movie. For example, a 50-year-old photograph of a not especially memorable event, would have near zero value for commercial purposes. However, it may be a useful artifact for a book on the time period. An author worried about infringing on copyright would most likely opt to forego using the picture rather than devote the resources necessary to track down the copyright holder for permission. The same would apply for a dated piece of music that almost no one has listened to for decades.

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39 In an extreme case, ASCAP, the recording rights organization, once requested that the Girl Scouts pay fees for singing copyrighted songs at their campfires. See Bumiller (1996).

The costs of arranging permissions would dwarf the potential benefits from using it in a movie.

To get an idea of the magnitude of the expenses associated with copyright, many companies find it necessary to buy digital assessment management systems, which cost about $20,000, just to keep track of the items to which they have purchased access.[40] Legal fees from even inadvertent infringements can easily run into the tens of thousands of dollars.[41]

In the case of recorded music, the development of digital technology has had a substantial negative effect on revenue. This is arguably a positive development for the economy as a whole. Two studies (Rob and Waldfogel 2006 and Waldfogel 2010) examining the welfare effects of unauthorized copying of recorded music found net short-run welfare gains from unauthorized file sharing. While this may seem obvious, Handke cites several studies showing that the supply of recorded material actually increased following the widespread practice of file sharing. By looking at measures of "greatest hits," Waldfogel (2011) found no evidence of deterioration in quality as a result of widespread file sharing.

Another key question with copyrights is the appropriate duration. Most analysis tends to find that older works have relatively little value. Rappaport (1998) found that most copyrighted works were of little commercial value at the time of expiration, though a minority were still generating considerable revenue. Landes and Posner (2004) found that most copyright holders did not file to extend their copyright after the initial 28-year period expired. They note that in 2001 only 1.7 percent of the books published in 1930 were still in print.

Handke observes some unintended effects of copyright. For example, copyright restrictions may slow the spread of new hardware that could be complementary to recorded material. Also, copyrights may affect the mix of work that people consume in ways that favor more established

40 See, for example: https://www.thirdlight.com/articles/dam-cost.

41 See, for example: https://webdam.com/blog/true-costs-of-copyright-infringement/.

performers. The review cites several studies showing that less well known musicians had better sales and more attendance at live performances after file sharing became common. These studies are far from conclusive, but such an effect is plausible. In an experimental analysis, Salganik et al. (2006) found that people listened more frequently to music that they were told was popular. The implication is that marketing certain songs or musicians will increase the extent to which the public listens to them at the expense of musicians who are not favored. If copyright gives entertainment companies an incentive to promote certain performers, the public's choice in music will be skewed toward a narrower group of performers.

Copyright protection in the digital age has required increasingly punitive law enforcement measures and extraordinary efforts to inculcate respect for copyright monopolies. A Minnesota woman was fined $222,000 in 2007 for allowing 24 songs to be downloaded off of her hard drive through a peer-to-peer file-sharing system.[42] A provision of the Trans-Pacific Partnership requires that countries adopt criminal penalties for copyright infringement. In order to promote respect for copyright laws, an industry trade group even created a patch for Girl Scouts and a merit badge for Boy Scouts.[43]

These costs are in addition to the deadweight losses, which are definitionally associated with copyright monopolies, that raise the price above the marginal cost of production, and they are likely to be substantial relative to the amount paid to performers, writers, songwriters, and other creative workers. A recent analysis of the impact of the Trans-Pacific Partnership's copyright provisions in New Zealand placed the elasticity of demand for books at -1.77 and the elasticity of demand for recorded music at -1.41 (New Zealand Ministry of Business, Innovation, and Employment 2015). These estimates imply that for every dollar that copyright raises the price of books and recorded music, the effective cost to consumers in

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42 See: http://abcnews.go.com/US/supreme-court-lets-verdict-stand-recording-industry-case/story?id=18765909.

43 See: http://www.ipoef.org/?page_id=30 and http://arstechnica.com/gadgets/2006/10/8044/.

higher prices and deadweight loss is $1.39 in the case of books and $1.22 in the case of recorded music. If creative workers gets 70 percent of the copyright margin in the case of recorded music (in other words, 70 percent of the mark-up associated with copyright goes to creative workers as opposed to promoters, marketing, and profits), this implies that the cost to consumers is $1.74 for every dollar that goes to creative workers. If the share going to creative workers is 50 percent, then the cost to consumers is almost $2.00 for every dollar going to creative workers.

Patents and copyrights are often used to protect software. Analyzing the success of open-source software, Lerner and Tirole (2000), focusing on the motivations of the individual developers, found that many of them are prepared to devote large amounts of time without any direct monetary reward. Instead, they perform the work out of intellectual curiosity or as a way to advance their reputation.

Bessen (2005) focuses on the willingness of companies to support open-source systems. The study argues that this support can be an efficient way to gain a number of programmers' insights into difficult problems that would not be addressed by standardized software. In this way, open-source software may be a useful complement to proprietary software and other services provided by a company. These insights help in assessing how technology can advance in the absence of patent or copyright protection.

In sum, there are clearly substantial costs associated with copyright protection, costs that have increased substantially as a result of digital technology. The response of the U.S. government has been to promote stronger and more punitive laws and to require third parties to share in enforcement costs.

Alternatives to the current patent system

The prior sections provide solid grounds for questioning the extent to which patent and copyright protection are efficient mechanisms for supporting innovation and creative work. While some research suggests that there is no need for any form of explicit government intervention to support innovation and creative work, it is likely that the market would undersupply both in the absence of some form of

government support. This is especially likely to be the case in the areas where patents were found to provide the greatest subsidy for research: pharmaceuticals and medical equipment.[44] In these areas, survey results typically found that patents provided an effective subsidy in the range of 30 percent of the cost of research. By contrast, research on the value of patents in other sectors suggested that the subsidy provided by patents was generally in the range of 5 to 15 percent.

The higher implicit subsidy found for the pharmaceutical and medical supply industries suggests the need for different mechanisms to support research and innovation in these sectors. In these two industries, the patent is typically responsible for the bulk of the price of the product, often creating a large gap between the patent-protected price and the cost of production. The discussion below outlines a mechanism for direct public funding of research in these two industries, and then describes a modified patent system for all other sectors.

The rationale for public financing for pharmaceutical and medical equipment R&D

The importance of patents in the pharmaceutical and medical equipment industry is reflected in the large gap between patent-protected prices and the cost of production. As noted earlier, patent-protected drugs can sell at prices a hundred times higher than their generic equivalents. Medical equipment follows a similar pattern. The cost of manufacturing even the most complex scanning devices or other cutting-edge equipment will rarely be more than a few thousand dollars, yet patent protection allows these products to sell for hundreds of thousands or even millions of dollars. This cost is recouped in high prices paid by patients (or their insurers) for procedures that may have a trivial marginal cost.

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44 Some studies have found large implicit subsidies for patents in the chemical industry, raising an argument for treating chemicals the same way as pharmaceuticals and medical equipment. However, because chemicals are mostly sold as an intermediate good, they do not raise the same set of issues as pharmaceuticals and medical equipment.

The large gap between price and marginal cost has exactly the sort of consequences that economic theory predicts. The first and most obvious is that many people are forced to get by without drugs that are actually produced at a low marginal cost.[45] Patients will also take less than the recommended dosage or skip days in order to reduce the cost of their drugs.

A simple calculation of the deadweight loss associated with patent protection of drugs indicates that patients incur substantial costs as a result of not being able to pay free market prices.[46] **Table 5-2** shows the deadweight loss based on 2016 expenditures of $450 billion, assuming alternatively that drugs would sell for 10 percent and 20 percent of their current prices if there were no patent or related protections.[47] The table applies elasticities of 15 percent, 25 percent, and 50 percent.

TABLE 5-2

Annual deadweight loss due to patent protection of drugs, based on 2016 expenditures of $450 billion

(billions of 2016 dollars)

	Elasticities		
	0.15	0.25	0.5
Free market price = 10 percent of current prices	$90.8	$171.2	$475.7
Free market price = 20 percent of current prices	$60.1	$109.0	$271.9

Source and notes: BEA (2016) and author's calculations, see text.

In the case where the elimination of patent protections reduces average drug prices by 80 percent, and elasticity is just 0.15, the deadweight loss from current protection would still be over $60 billion

45 Some patients don't take drugs due to their costs, resulting in adverse health outcomes. A recent study found substantial negative health effects of drug copayments in Canada among older people, even though the expected payments were relatively limited compared to what most patients would face in the United States. See Anis et al. (2005).

46 The deadweight loss represents the potential benefits that patients would have received from taking the drug, who did not do so because they had to pay the patent-protected price rather than the free market price.

47 The $450 billion is taken from BEA (2016), Table 2.4.5U, line 120. It increases the 2015 figure by 9.5 percent, the same increase as occurred between 2014 and 2015. The calculations assume a constant elasticity of substitution consumption function.

given 2016 demand and prices. In the case of a 90 percent drop the deadweight loss would be $90.8 billion at 0.15 elasticity and $171.2 billion at 0.25 elasticity.[48] These are substantial losses by any measure. The $90.8 billion loss would equal almost 0.5 percent of 2016 GDP, and the $171.2 billion loss would equal more than 0.9 percent.

In addition to the deadweight losses, patent protection also imposes substantial costs in the form of time and resources that are wasted as a result of patent protected prices. These costs take a variety of forms.

First, even where patients have insurance that covers the cost of expensive drugs, the high price often will lead the insurer to demand additional proof that the patient needs the drug in question. Insurers may require additional tests or a second opinion. The high cost of patent-protected drugs has created a whole industry of intermediaries — pharmacy benefit managers — who negotiate with drug companies on behalf of insurers, hospitals, and other institutions. There would be no need for this industry if drugs sold at free market prices.

Because the government is a big payer for drugs through Medicare, Medicaid, and other public health care programs, it can set standards that effectively determine how much private insurers pay. Thus, the pharmaceutical industry is heavily involved in lobbying, both through its own agents and through the consumer groups it mobilizes.[49] The

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48 These calculations would understate the loss substantially insofar as the price declines are uneven. In effect, the assumption in the calculations is that the price of all drugs declines by 80 percent or 90 percent. The Food and Drug Administration (FDA) puts the reduction in the price of brand drugs in a mature generic market at more than 90 percent (FDA 2015). While many drugs are already available as generics, even these would often see large price declines in a free market. Some generics have the benefit of the six-month period of exclusivity as the first generic in the market. Also, in many cases generic manufacturers will still face licensing fees of various types, even if the main patent on a drug is no longer applicable. On the other side, the price decline for the most expensive drugs may be in excess of 99 percent. Using averages would understate the loss. Taking these differences into account would almost certainly lead to a larger measure of deadweight loss.

49 Pharmaceutical companies are often major funders of organizations established as support groups for victims of specific diseases and their families. These support groups are often encouraged to lobby insurers and the government to pay for

pharmaceutical industry ranked fifth in campaign contributions to members of Congress in 2016 (Center for Responsive Politics 2016a). The broader category of health-related industries ranked second, behind only finance, insurance, and real estate in total contributions to politicians (Center for Responsive Politics 2016b).

The efforts of drug companies to secure patent protection are not just a question of them getting more money at the expense of competitors or the general public. They may also be pursuing policies that are detrimental to public health. For example, pharmaceutical companies that produce pain relief medication have been leading the fight against medical marijuana, which has been shown to be an effective substitute for prescription pain medications (Ingraham 2016). There can be major consequences for public health as patients take stronger and more addictive medications when marijuana may be an effective treatment. Similarly, the industry uses its ties to patient advocacy groups to try to keep generic competitors from being covered by the government or insurers (Pollack 2016). This is the sort of corruption one would expect to find when there is a huge gap between the monopoly price and the cost of production.

Because so much money is at stake, pharmaceuticals are a prime target for litigation. Drug companies routinely bring suits to harass competitors, discourage generic competition, or gain a slice of the patent rents associated with a highly profitable drug. The pharmaceutical and medical equipment industries together accounted for almost a quarter of patent-related lawsuits from 1995 to 2014. The suits in the pharmaceutical sector had the highest median damage settlement, with medical equipment a close third just behind telecommunications (PricewaterhouseCoopers 2015).

In any legal battle over pharmaceuticals, where the brand drug manufacturer is defending the right to sell at a monopoly price for the duration of the patent and the potential generic entrant is looking for the right to sell in a competitive market, there is a fundamental asymmetry:

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expensive drugs sold by the sponsoring pharmaceutical company. See, for example, Nuñez (2006).

the brand manufacturer stands to lose much more than the generic producer stands to gain. As a result, the brand producer has an incentive to spend much more on legal expenses, and it may be tempted to offer side payments to discourage entry by the generic competitor. Such collusion is illegal, but it is hard to detect, especially if the payment takes the form of a contract (e.g., the generic producer is paid to manufacture one of the brand manufacturer's drugs) that could have been reached without any collusion. A 2010 study by the Federal Trade Commission (FTC) estimated the annual cost to consumers of these "pay to delay" agreements at $3.5 billion (FTC 2010).[50]

Another problem with the large gap between price and marginal cost is that it provides an incentive for drug companies to conceal evidence that reflects poorly on its drugs. If they find evidence that their drug may not be as effective as claimed or possibly even harmful for some patients, the enormous gap between price and marginal cost gives them an incentive not to disclose this information. This was the allegation in the case of the arthritis drug Vioxx, where the manufacturer allegedly concealed evidence that the drug increased the risk of heart attack and stroke among patients with heart conditions. Drug companies also have an incentive to promote the use of their drug in situations where it may not be appropriate. Efforts to promote drugs for "off-label" use are a regular source of scandal in the business press.

A recent analysis that looked at five prominent instances in which it was alleged that drug companies either concealed information about their drugs or marketed them for inappropriate uses found that the cost born by patients was in the range of $27 billion annually over the years 1994–2008 (Katari and Baker 2015). While this estimate is far from precise, it suggests that the cost associated with improper drug use due to deliberate misrepresentations and mis-marketing is substantial, quite likely in the range of the amount spent by the industry on drug research. It is worth repeating that these costs, in terms of bad health outcomes, are the result of deliberate actions stemming from the perverse incentives created

50 The Public Interest Research Group compiled a list of 20 of the most important cases of this sort of pay for delay; see U.S. PIRG (2013).

by patent monopolies, not costs from the sort of mistakes that are an inevitable part of the research process.

Another issue with patent monopolies is that they distort the research process by encouraging drug companies to pursue patent rents rather than find drugs that meet urgent health needs. If a pharmaceutical company produces a drug for a particular condition that earns large amounts of revenue, its competitors have a strong incentive to try to produce similar drugs for the same condition, in order to capture a share of the rents.

For example, Merck and AbbVie, along with several smaller drug manufacturers, are rushing to market alternatives to Sovaldi as a treatment for hepatitis C.[51] In the context in which Gilead Sciences, the maker of Sovaldi, has a monopoly on effective treatments for hepatitis C, this sort of competition is highly desirable because it will lead to lower prices. However, if Sovaldi were being sold in a free market at $500 to $1,000 for a course of treatment, there would be little incentive to invest research dollars finding treatments for a condition for which an effective drug already exists. If drugs were sold without protection, research dollars would usually be better devoted to developing a drug for a condition where no effective treatment exists than developing duplicative drugs for a condition that can be well-treated by an existing drug.

Patent protection also is likely to slow and/or distort the research process by encouraging secrecy. Research advances most quickly when it is open. However, companies seeking profits through patent monopolies have incentive to disclose as little information as possible in order to avoid helping competitors. This pressure forces researchers to work around rather than build upon research findings. Williams (2010) found that the patenting of DNA sequences in the Human Genome Project slowed future innovation and product development by between 20 and 30 percent.

Finally, relying on patent incentives to support medical research encourages drug companies to direct research toward finding a patentable product. If, for example, evidence suggests that a condition can be most

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51 See, for example: http://www.investopedia.com/ask/answers/052215/who-are-gilead-sciences-gild-main-competitors.asp.

effectively treated through diet, exercise, environmental factors, or even old off-patent drugs, a pharmaceutical manufacturer would have no incentive to pursue this research.[52] Ideally, the manufacturer would make this evidence publicly available so that researchers supported by the government, universities, or other nonprofit organizations could pursue it, but there is little incentive for them to go this route. In fact, if they are concerned that such research could lead to an alternative to a patentable product that they might develop or be in the process of developing, their incentive is to conceal the research.

For all of these reasons, patent-supported research is particularly ill-suited for the pharmaceutical sector, as well as for the medical equipment sector.[53] It is likely that a system of directly funded research, paid for by the government, would be considerably more efficient for the development of new drugs and medical equipment. Such a system is outlined in the next section.[54]

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52 The United States and many other countries now allow for the patenting of a new use for an existing drug; however, there are still likely to be limits to the extent to which this might provide incentives for researching new uses of a drug. If it turned out that a common drug, like aspirin, was an effective treatment for some other condition, it would be very difficult to keep people from using the cheap generic versions for the newly discovered treatment, even if it violated the patent.

53 All the arguments made above on pharmaceuticals would also apply to research to develop medical equipment.

54 This discussion pursues the logic of directly funded research. There have been several proposals for creating a prize system for buying out patents and placing them in the public domain. While a prize system would have enormous advantages over the current system, most importantly because drugs would be available at their free market price, it shares some of the major drawbacks with the current patent system. Mainly, it would still encourage secrecy in the research process, because companies would have the same incentive as they do now to prevent their competitors from gaining the benefit of their research findings. The awarding of prizes may also prove problematic. The company that manages to patent a drug may not be the one responsible for the key scientific breakthroughs responsible for its development. In principle, prizes could be awarded for important intermediate steps, not just achieving a final endpoint, but this is likely to make the prize process complicated and contentious.

Publicly financed medical research

The basic logic of a system of publicly financed medical research would be that the government expand its current funding for biomedical research, which now goes primarily through the National Institutes of Health, by an amount roughly equal to the patent-supported research now conducted by the pharmaceutical industry. PhRMA, the industry trade group, puts this funding at roughly $50 billion a year, or 0.3 percent of GDP, a figure that is also consistent with data from the National Science Foundation. That would be a reasonable target, with the idea that public funding would eventually replace patent-supported funding.[55] Adding in research on medical equipment and tests would increase this figure by $12–15 billion (National Science Foundation 2012).

In order to minimize the risk of political interference and also the risk that excessive bureaucracy could impede innovation, the bulk of this funding should be committed to private firms under long-term contracts (e.g., 10–15 years).[56] This practice would allow for the imposition of clear rules that apply to all research directly or indirectly funded by the public sector, without a need for micro-management. The contracts would be subject to regular oversight for their duration, but the contractors would be free to set priorities for which lines of research to support. The contractors could freely subcontract, and they could use

55 It would be necessary to have some system of international coordination so that the United States was not funding research for the whole world. This would presumably involve some payments scaled to GDP, with richer countries paying a larger share of their income. While there would undoubtedly be some problems working through such a system, the current system of imposing patent and related protections on U.S. trading partners has been quite contentious.

56 The use of private drug companies also has a potentially valuable benefit from a political economy standpoint. There is no reason that the existing pharmaceutical companies could not bid for public research money, as long as they are prepared to abide by the conditions placed on this funding. This means that insofar as they are efficient in their conduct of research, they would be able to continue to exist and profit on this sort of system. This should reduce their political opposition to an alternative funding mechanism. But insofar as their expertise is primarily in marketing rather than developing drugs, they would run into difficulties under this alternative system.

their funds to buy research produced by other companies, just as the major pharmaceutical companies do now. As the period for a contract approached its end, the contractor could attempt to gain a new long-term contract. It would argue its case based on its track record with the prior contract.

The rules governing these contracts would dictate that all results stemming from publicly financed research be placed in the public domain, subject to "copyleft"-type restrictions.[57] Thus, any patents for drugs, research tools, or other intermediate steps developed by contractors or subcontractors would be freely available for anyone to use, subject to the condition that any subsequent patents would also be placed in the public domain. Similarly, test results used to get approval for a drug from the Food and Drug Administration would be available for any generic producer to use to gain approval for their own product.

In addition to requiring that patents be placed in the public domain, there would also be a requirement that all research findings be made available to the public as quickly as practical. This means, for example, that results from pre-clinical testing be made available as soon as they are known. This requirement should prevent duplication and allow for more rapid progress in research, and would apply to both direct contractors and any subcontractors.[58]

This disclosure requirement would not be a negative for participants in the context of this open-source contract system. Because the goal is to generate useful innovations rather than procure a patent, a contractor would be able to make an effective case for the usefulness of its work even if competitors were the ones that ultimately used the work to develop a useful drug or medical device. The incentive in this system is to

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57 Copyleft is a type of copyright developed by the Free Software Movement, under which a copyrighted software can be freely used as long as any derivative software is also put in the public domain subject to the same condition. See: https://www.gnu.org/licenses/copyleft.en.html.

58 This is the sort of issue that would be examined in periodic reviews of contractors. Excessive delays by a contractor in posting findings on an ongoing basis would be grounds for revoking the contract. Contractors would also be held responsible for the behavior of any subcontractors, which would also be bound by the requirement to post findings in a timely manner.

disseminate any interesting findings as widely as possible in the hope that other researchers will build upon them.

The contracting system in the Defense Department offers a model for contracting in pharmaceutical research. When the Defense Department is planning a major project, such as a new fighter plane or submarine, it will typically contract with a major corporation like General Electric or Lockheed Martin that in turn subcontracts much of the project, because it is not prepared to do all the work in-house. Contractors conducting research developing pharmaceuticals or medical equipment could do the same, although the expected results will be somewhat less clearly specified. While less well-defined outcomes are a disadvantage of contracting with medical research, a major advantage is that there would be no excuse for secrecy. Military research requires secrecy to prevent access to the latest technology by potential enemies, but biomedical research will be advanced by allowing the greatest possible access. Secrecy has often been an important factor allowing military contractors to conceal waste or fraud, because only a very select group of people would have access to the specific terms of a contract and the nature of the work a company is doing. In the case of bio-medical research, there is no reason that the terms of the contract would not be fully public. And, all research findings would have to be posted in a timely manner. With such rules, it should be possible to quickly identify any contractor whose output clearly did not correspond to the money they were receiving from the government. In spite of the instances of waste and fraud in military contracting, it is important to remember that it has been effective in giving the United States the most technologically advanced military in the world.[59] In other words, direct contracting has accomplished its purpose even in a context that should be much less favorable to it than bio-medical research.

Because the system of patent protection and rules on data exclusivity are now enshrined in a large number of international agreements that would be difficult to circumvent, it is important that an

59 This is not a comment on the actions of the U.S. military; it is simply noting its technological capabilities.

alternative system work around this structure. As proposed here, patent protection under current rules would still be available to drug companies conducting research with their own funds. However, they would run the risk that at the point when they have a drug approved by the Food and Drug Administration (FDA), there is a new drug available at generic prices that is comparably effective. This sort of competition would likely force the company to sell its drug at a price comparable to the generic, leaving it little margin for recouping its research costs.

The risk of this sort of generic competition should make the current system of patent-financed drug development unprofitable, especially if the industry's claims about its research costs are anywhere close to being accurate. So the existing rules on patents could be left in place, even as a new system of publicly financed research comes to dominate drug development.

The cost-benefit arithmetic of an alternative system

The arithmetic summing the extra costs, deadweight losses, and wasteful rent-seeking behavior associated with patents, compared with the amount of actual research that is funded, suggests the opportunity for large gains through an alternative system. The first and most obvious advantage is that all the drugs and medical equipment developed through this process would be immediately available at free market prices. Instead of costing hundreds of thousands of dollar a year, breakthrough cancer drugs might cost $1,000 a year, or even less. The cost would be the price of safely manufacturing these drugs and with very few exceptions, that cost would be quite low. With drugs selling at prices that even middle-income families could readily afford, the whole industry of middle-men that has grown up around mediating between the drug companies and insurers, hospitals, and patients would disappear. There would be no need for it.

This would also end the horror stories that many patients must now endure as they struggle to find ways to pay for expensive drugs even as they suffer from debilitating or potentially fatal diseases. Doctors also would not be forced to compromise in prescribing a drug they consider inferior because it will be covered by a patient's insurance when the

preferred drug is not. Also, doctors would likely make better informed prescribing decisions because no one would stand to profit by having them prescribe a drug that may not provide the best treatment for their patient.

A similar story would apply to the use of medical equipment. In almost all cases, the cost of manufacturing the most modern medical equipment is relatively cheap. The cost of usage is even less. For example, the most modern screening equipment only involves a small amount of electricity a limited amount of a skilled technician's time, and the time of a doctor to review the scan. Instead of a scan costing thousands of dollars, the cost would likely be no more than $200–300. Here also, the price would then be a minor factor in deciding how best to treat a patient. A doctor would naturally recommend the device that best meets the patient's needs. And in a context where no one has an incentive to mislead about the quality of the equipment, the doctor is likely to make better choices. The same would be the case with various lab tests, all of which would be available at their free market price. With few exceptions, this would be a trivial expense compared to the current system.

Table 5-3 shows the potential gains from replacing patent-supported research with direct public funding under three sets of assumptions. The most optimistic scenario, shown in column 1, assumes that 75 cents of public spending on research is roughly equivalent to $1 of spending financed by patent monopolies. The greater efficiency is based on the idea that increased openness and the elimination of unnecessary duplication will lead to more effective research. It also assumes that prescription drugs would sell for 10 percent of their current price if there were no patent or related protections.[60] In this case, the implied annual savings would be $349.5 billion. Adding in the reduction in deadweight loss from the high elasticity case shown in Table 5-2 brings the total benefits to more than $800 billion a year, equal to 4.3 percent of GDP.

60 With some drugs the price may be high not because the compound itself is subject to patent protection but because one of the inputs is. The implicit assumption in this discussion is that the inputs would also be in the public domain because they would have been produced with public funding.

TABLE 5-3

Gains from ending patent protection for pharmaceuticals and medical equipment

(billions of 2016 dollars)

	High savings	Middle savings	Low savings
Drugs			
Current spending	$430.0	$430.0	$430.0
Patent-free cost	$43.0	$64.5	$86.0
Additional research	$37.5	$50.0	$75.0
Net savings	**$349.5**	**$315.5**	**$269.0**
Reduction in deadweight loss	$475.7	$140.1	60.1
Total savings	$825.2	$455.6	$329.1
Medical equipment			
Current spending	$50.4	$50.4	$50.4
Patent-free cost	$15.1	$15.1	$15.1
Additional research	$11.2	14.9	$22.4
Net savings	**$24.1**	**$20.4**	**$12.9**

Source and notes: BEA (2016) and author's calculations; see text. For medical equipment, the 2016 spending level is a projection from the Centers for Medicare and Medicaid Services (CMS). The estimate for current research spending is taken from data for 2012 from the National Science Foundation and increased by 20 percent to account for growth between 2012 and 2016.

Column 2 shows an intermediate scenario in which $1 of public money for research is needed to replace $1 of patent-supported research. This case assumes that prescription drugs would cost 15 percent as much to produce as they do today if all patent and related protections were eliminated. In this case the savings would be $315.5 billion. Adding in the reduction in deadweight loss brings the total net benefit to more than $450 billion a year.

Column 3 shows a scenario in which it takes $1.50 of public money to replace $1 of patent-supported research. This ratio implies that because money is going through the government, the research process becomes hugely less efficient than is currently the case. This is in spite of the fact that the research is now fully open, so that all researchers can benefit quickly from new findings, and a main motivation for unnecessary duplicative research has been eliminated. This scenario assumes that it would cost 20 percent as much to manufacture drugs in a world without patent and related protections as is the case at present. In this scenario, the

savings would still be $269 billion annually or 1.5 percent of GDP. Adding in the reduction in deadweight loss from the most inelastic scenario would put the total net benefit at $329 billion annually.

The next set of rows shows the benefits from publicly funded research for medical equipment. The assumption in all three cases is that the cost of buying and using this equipment would fall by 70 percent if it were sold in a free market. The optimistic scenario assumes that 75 cents in publicly funded research is equivalent to a dollar of patent-supported research, the middle scenario assumes they are equally effective, and the pessimistic scenario assumes that $1.50 in publicly funded research is needed to replace $1.00 in patent-supported research. In these cases, the net annual savings would range from $12.9 billion to be $24.1 billion.[61]

While publicly financed research would require the government to directly commit funding for research, additional tax revenue should not be necessary. The government already directly or indirectly pays for a large portion of prescription drug expenditures through Medicare, Medicaid, and various other health care programs. In addition, it effectively subsidizes private spending on drugs as a result of the tax deductibility of employer-provided health insurance and other expenses. **Table 5-4** shows the Centers for Medicare and Medicaid Services (CMS) projections for 2016 spending on prescription drugs and medical equipment by source (CMS 2014) as well as the assumed savings.

For Medicaid and other government programs, the assumed savings are 50 percent on both drugs and medical equipment, based on the fact that these programs typically pay substantially lower prices for drugs than do private insurers. In the case of Medicare, the savings are 70 percent on drugs and 50 percent on medical equipment, under the assumption that insurers within the program pay somewhat lower prices for drugs than do insurers not connected with Medicare. In the case of

61 Even these calculations don't fully capture the potential benefits from selling drugs in a free market. Centers for Medicare and Medicaid Services (CMS) projects that private insurers will pay just over $150 billion for prescription drugs and medical equipment in 2016. With insurance expenses averaging more than 20 percent of benefits paid out, a fall in these combined payments of $100 billion would imply savings of more than $20 billion in the administrative costs of insurers.

private insurers and out-of-pocket payments, it is assumed that savings to the government will equal 16 percent of current payments for drugs and 14 percent for medical equipment, based on drug prices falling 80 percent if not subject to patent protection and prices for medical equipment falling 70 percent. The calculation further assumes that 20 percent of this savings accrues to the government in the form of higher tax revenue, because taxpayers will deduct less money for health care expenditures.

TABLE 5-4

Savings to the government from publicly supported research for pharmaceuticals and medical equipment

(billions of 2016 dollars)

			Health insurance					
	Total	Out-of-pocket payments	Total	Private health insurance	Medicare	Medicaid	Other health insurance programs	Other third-party payers
Drugs								
Spending	$342.1	$48.3	$291.8	$142.0	$105.2	$33.8	$10.8	$2.0
Savings	$126.4	$7.7		$22.7	$73.6	$16.9	$5.4	
Medical equipment								
Spending	$50.4	$24.7	$25.0	$8.9	$8.5	$7.4	$0.1	$0.6
Savings	$12.7	$3.5		$1.2	$4.3	$3.7	$0.1	
Total savings	**$139.1**							

Source and notes: CMS (2014) and author's calculations, see text.

Even with these relatively conservative assumptions, the savings to the government based on the 2016 projections would still be over $139 billion,[62] which substantially exceeds the amount of public funding that

62 These calculations are based on CMS projections of spending on prescription drugs. Data from the Bureau of Economic Analysis (BEA) show spending levels that are more than 30 percent higher. A calculation of savings based on BEA spending levels would therefore be correspondingly higher.

would be needed to replace patent-supported research in even the most pessimistic scenario described above. In other words, there would be no need for additional tax revenue even in a relatively pessimistic scenario.

It is possible that there could be some short-term need for additional funding due to the lag between research spending and the development of new drugs. At least initially, there would be no savings from publicly funded research because all the drugs being sold would still be subject to the same protections as they enjoy today. The savings would accrue over time, as new drugs were produced through the public system and were sold at free market prices. For this reason, a switch to direct public funding of research may initially increase budget deficits while leading to substantial savings soon and over a period of time.

Publicly funded clinical trials

Switching all at once to a system of publicly funded research would likely be a difficult step politically and practically, involving a radical transformation of a massive industry of a kind rarely seen in the United States or anywhere else. Fortunately, there is an intermediate step toward a system of fully funded research that would offer enormous benefits in its own right.

There is a simple and basic divide between the pre-clinical phase of drug development and the clinical phase. The pre-clinical phase involves the development of new drugs or new uses of existing drugs and preliminary tests on lab animals. The clinical phase involves testing on humans and, if results warrant, proceeding to the FDA approval process. The clinical testing phase accounts for more than 60 percent of spending on research, although this number is reduced if a return is imputed on the pre-clinical testing phase, because there is a considerably longer lag between pre-clinical expenditures and an approved drug than with clinical tests.

The clinical testing process involves standard procedures and is therefore far more routinized than the pre-clinical phase. For this reason, it could be easily adapted to a program of direct public funding. The model could be the same as discussed earlier, with the government

contracting on a long-term basis with existing or new drug companies, but the contracts would specify the testing of drugs in particular areas. All results would be fully public, and all patent and related rights associated with the testing would be put in the public domain subject to copyleft-type rules. This procedure would likely mean that contracting companies might have to buy rights to a compound before initiating testing.

Separating out the clinical testing portion of drug development rather than fully replacing patent-supported research all at once has several advantages. First, particular areas of investigation could be segregated out for experimentation. For example, it should be possible to set aside a certain amount of funding for clinical trials for new cancer or heart drugs without fully replacing private support for research in these areas. Also, it should be possible to obtain dividends much more quickly in the form of new drugs being available at generic prices. The time lag between the beginning of pre-clinical research and an approved drug can be 20 years, but the clinical testing process typically takes about eight years and can be less if a drug's benefits become quickly evident in trials.

Another important early dividend from public funding of clinical trials is that the results would be posted as soon as they are available, meaning that researchers and doctors would have access not only to the summary statistics showing the success rates in the treatment group relative to the control group, but also to the data on specific individuals in the trial.[63] This access would allow them to independently analyze the data to look for differences in outcomes based on age, gender, or other factors. It would also allow for researchers to determine the extent to which interactions with other drugs affected the effectiveness of a new drug.

In addition, the public disclosure of test results may put pressure on the pharmaceutical industry to change some bad practices. The problem of misreporting or concealing results in order to promote a drug can arise during clinical testing. While misrepresented results can be a

63 Some information on individuals may have to be put into categories (e.g., age ranges rather than specific ages) in order to preserve the anonymity of patients. With rare diseases, these categories may have to be fairly broad, but it will still be possible to disclose more information than is currently available.

problem at any stage in the process, misrepresentations at the pre-clinical phase are unlikely to have health consequences because they will be uncovered in clinical testing. The problem of patients being prescribed drugs that are less effective than claimed or possibly harmful to certain patients due to misrepresentations occurs entirely during the clinical phase. If experiments with a limited number of publicly funded clinical trials can change the norms on disclosure of test results, they will have made an enormous contribution to public health.

Potential benefits from upfront funding and marginal cost pricing

While the savings shown in Table 5-3 are substantial, savings may not be the most important benefit from adopting a system of upfront research funding and marginal cost pricing. If drugs, scans, and tests were all sold in a free market, almost all would be relatively cheap, and all but the lowest-income households would be able to afford the drugs and tests considered beneficial to their health. The elimination of this potential financial burden would be an enormous benefit.

In addition, there are good reasons to believe that a switch to a system of marginal cost pricing with fully open research will lead to better health outcomes. First, the current system of patent monopolies provides drug companies, manufacturers of medical equipment, and proprietary testing companies with an enormous incentive to misrepresent the benefits of their products and conceal potential negatives. If all of these items were sold in a free market where competition had pushed profits down to normal levels, there would be little incentive to misrepresent the safety and/or effectiveness of a product in order to boost sales. The additional profit from increased sales in a competitive market does not provide the same sort of incentive for corruption as the opportunity to sell more of a product at monopoly prices.

The other reason why an alternative system of open research should lead to better outcomes is that the evidence for effectiveness of a drug or procedure would be directly available to doctors and researchers rather than held in secret by a drug company or medical equipment manufacturer. Doctors will be able to make decisions that focus on the

specific situation of their patients. If more than one drug is available for treating a condition, a doctor will have access to evidence about relative effectiveness for men versus women, or for overweight people, or people with other health conditions, allowing the doctor to make more-informed decisions for treating patients.

Also, it is possible that better drugs and equipment will be available if openness allows research to advance more quickly. If open research turns out to advance more quickly, as some studies have indicated, the move away from patent-supported research may hasten the invention of treatments and cures for a wide variety of conditions.

In addition to the benefits to patients and savings for government, a system of marginal cost pricing will yield substantial savings to the economy. The massive marketing industry that has developed to promote sales of drugs would disappear, freeing up resources for productive uses. Lawyers specializing in intellectual property tend to be among the most highly paid members of the profession, and with marginal cost pricing the number of lawyers and lobbyists required for court contests and K Street negotiations would plummet. If the demand for lawyers to press or defend patent suits in prescription drugs declined it would free up a substantial share of these lawyers to pursue other lines of work.

Marginal cost pricing also would reduce the amount of money flowing through the health care insurance industry. On average, insurers take over 24 percent of the money paid to providers to cover administrative costs and provide their profit.[64] Reducing spending on drugs and medical equipment by $100 billion annually would imply savings on administrative expenses of more than $20 billion a year.

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64 This calculation comes from taking the $194.6 billion estimate for the net cost of administering health insurance in 2014 from CMS (2014), national health expenditures data for 2014 (Table 2), and dividing it by $796.4 billion, the CMS estimate for 2014 payments by insurance companies after subtracting administrative expenses (Table 3).

Non-patent-supported research outside of the health care sector

While the abuses and inefficiencies of the patent system have the greatest consequence in the prescription drug industry and other health sectors, similar problems arise elsewhere. In most other sectors, patents are less important for supporting research and innovation because factors such as a first-mover advantage and complementary services tend to be more important in giving companies an edge. In this context, it might be desirable to preserve the patent system but reduce its importance.

As noted earlier, a number of trade agreements commit the United States to a set of rules, including 20-year patent duration, which would preclude simply altering the basic structure of the patent system. However, the government can incentivize firms to accept weaker patent rules. Because some of the worst abuses stem from patent trolls who make dubious legal claims based on older patents, a major reform would be a reduction in the period of patent duration (Love 2013). A patent length of three to five years would allow firms to protect their use of new technologies for a limited period while giving patent trolls little opportunity to dredge up old patents to extort successful innovators.

What kinds of incentives would convince firms to accept a shorter patent duration? One possibility is an expanded R&D tax credit.[65] The current credit is constructed as a marginal credit of 14–20 percent of R&D expenditures in excess of spending over a prior base period; as currently structured it costs $18 billion annually, as of 2016, or 0.1 percent of GDP.[66] This general credit could be eliminated and replaced with a credit of 10–15 percent of all R&D expenditures, allowed on the condition that all patents claimed by the company are open to the public under the copyleft rules after three to five years. After that, any company could make use of the patent, provided it also agreed to the shorter duration. Such rules would still allow corporations to have the full 20-year patent

65 Dechezlepretre et al. (2016) provide evidence on the effectiveness of the R&D tax credit as currently structured in promoting research spending.

66 The structure of the tax as well as the estimate of the cost can be found in CBO (2015b).

term required under trade agreements, but they would have to forego the R&D tax credit and free access to material subject to copyleft patents.

This set of incentives should provide a mix that is roughly comparable to that provided by the current patent system and tax credit. **Table 5-5** shows the National Science Foundation's estimates of R&D spending by sector for 2012, the most recent year available. Total spending was about 1.9 percent of GDP; removing spending by pharmaceuticals and other health related industries reduces this share to 1.45 percent.[67] A tax credit of 10–15 percent would cost between 0.15 percent and 0.22 percent of GDP if the take-up rate were 100 percent, but this assumption is clearly too high. More likely, 60–80 percent of spending would be covered by this system, implying a cost between 0.09 percent and 0.18 percent of GDP, or between $16 billion and $29 billion in the 2016 economy. At the low end, this is about the cost of the current R&D tax credit, at the high end it is about 50 percent more. If this system led to a comparable amount of research, the benefits to the economy should exceed the additional expense.

TABLE 5-5

Medical and non-medical R& D expenditures

(billions of 2012 dollars)

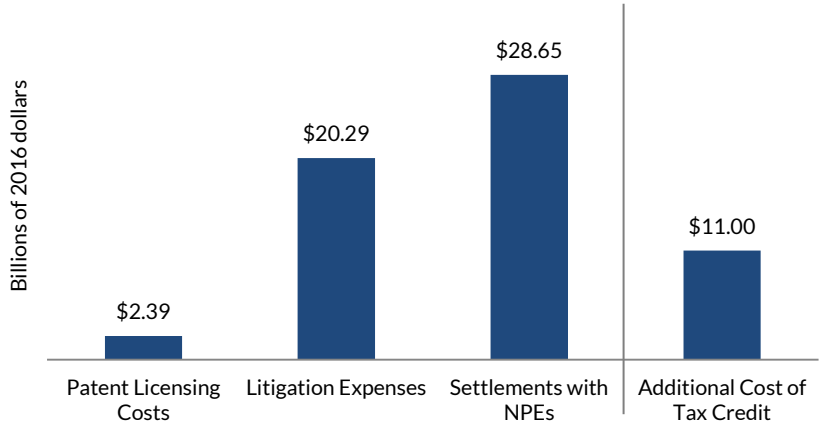
	2012	GDP shares	Tax credit	
			10%	15%
GDP	$16,155.3			
Total	**$302.3**	**1.87%**	**30.2**	**45.3**
Pharmaceuticals and medicines	$48.1	0.30%	4.8	7.2
Navigational, measuring, electromedical, and control instruments (50%)	$8.0	0.05%	0.8	1.2
Electromedical, electrotherapeutic, and other irradiation apparatus	$4.4	0.03%	0.4	0.6
Biotechnology	$7.4	0.05%	0.7	1.1
All other	$234.425	1.45%	0.15%	0.22%

Source and notes: National Science Foundation (2012).

67 This calculation counts 50 percent of the spending in the category "navigational, measuring, electromedical, and control instruments" as being health related.

Figure 5-1 compares the spending implied from this alternative tax credit to the expenses from the current patent system. The expenses shown are the annual costs of patent applications, the litigation costs of defending patent suits, and the annual cost of settlements as estimated by Bessen and Meurer.[68] (All numbers are scaled to 2016 GDP.)

FIGURE 5-1
Expenses associated with patents versus the cost of the tax credit



Source and notes: Bessen and Meurer (2012), Boldrin and Levine (2013), and author's calculations; see text.

In the low-end estimate, the tax credit would imply modest savings compared to the current credit.[69] At the high end, the additional cost of the credit would be $11 billion in the 2016 economy. Working off of the Levine and Boldrin calculation, companies would spend more than one-fifth of this amount just on the filing of patents. While firms would still have motivation to apply for patents under this alternative system, the incentive would be diminished, so the number of patent applications

68 The $5 billion estimate of defendants' litigation costs in suits initiated by NPEs is multiplied by four to include the plaintiffs' expenses and to account for the cost of lawsuits that do not stem from NPEs.

69 This is not entirely accurate, because a portion of the current credit goes to firms in the health care sector.

would likely fall sharply. The cost of litigation derived from Bessen and Meurer (2012) in the 2016 economy is $20.3 billion — almost twice as much as the high-end net cost of the tax credit. The cost of settlements with patent trolls is $28.6 billion, two-and-a-half times as much as the high-end cost of the credit.

These calculations suggest that the economy would be substantially better off with a system that relied more on tax credits and less on patent protection to support research. Of course, the costs from patent litigation would not fall to zero even in a scenario where tax-credit support became the dominant mode for financing research. There would still be some litigation even associated with the shorter patents and the government would have to be prepared to protect its patents for the duration of the copyleft period. In addition, some firms will opt to remain outside the tax-credit system.

But the increased competition from having fewer items subject to patent protection is likely to mean lower prices in a range of areas. And having more research freely available to innovators is likely to hasten the pace of innovation, particularly by smaller firms and start-ups for whom patent rights, and the negotiation of them, is a major expense. If small firms could count on supporting more of their own research through a tax credit, they could innovate in the areas dominated now by large firms and have less fear that a competitor might expose them to costly litigation.

This dual-track public and private system will require provisions to prevent gaming. Companies might exploit the free access to technology and the R&D tax credit to secure for themselves a full 20-year patent. It would be all but impossible, for instance, to police the separation whereby some parts of a firm are getting the tax credit and access but other parts are ostensibly fully funding their own research and are thereby entitled to long patents. To prevent this, the receipt of the tax credit and free access to copyleft material by any subsidiary of a firm would preclude 20-year patent protection for the whole firm. Similarly, the rules on short patents would have to apply to companies and patents purchased by a firm that was within the tax-credit/copyleft system.

If the incentives are structured properly, though, few large firms would find it advantageous to stay outside the system. The access to the

tax credit and the free use of copyleft material should far exceed the potential benefits of additional years of patent protection. As a result, it would be difficult to envision a company like Google or General Electric remaining outside the system. Also, the ability of larger companies to benefit from the network effect of having their technology widely adopted would provide a further incentive to go with the tax-credit/copyleft system.

Wide adoption of the tax-credit/copyleft system would drastically reduce the number of patent suits and narrow the space of operation for patent trolls, simply in terms of the odds. If the short patent associated with the tax-credit system were five years, and everyone was in the system, then the number of patents in force at a point in time would drop by 75 percent.[70] If the patent were three years, then the drop would be 85 percent, even before taking into account the likely collapse in the number of patents in pharmaceuticals and medical equipment when direct public funding largely replaces patent monopolies in these sectors.

In fact, the actual decline in the number of patents in effect is likely to be even larger. Because the life of the patent will have been shortened, patents will be of less value. Therefore many companies may opt not to patent inventions that they would patent under the current system. The net result of this change would be far fewer resources getting wasted in filing patents and patent suits and far less concern on the part of innovative companies and individual inventors over the risk of being sued for patent infringement.

It will be necessary for the government to be vigilant in protecting the patents subject to copyleft rules, both in the case of patents that grew out of research supported by the tax credit and also patents that resulted from direct public funding in the health care sector. Enforcement of these patents would be a great activity to be contracted out to private law firms paid largely on commission. This would minimize the risk that corporations could use their power to stay outside of the public funding

70 This calculation assumes that the number of patents issued each year is constant.

and tax-credit system and still gain free access to the technology developed through these systems.[71]

While the shortening of patent durations in most sectors is not likely to lead to the same collapse of prices that the ending of patent monopolies would cause in the health care sector, it should result in more competition and innovation, along with some drop in prices. There would be more pressure on larger established companies to constantly innovate and improve their products, because they could not count on a lengthy period of patent monopolies to protect them from competitors. In addition, the free access to a vast amount of technology on a copyleft basis to both large firms and smaller start-ups should accelerate the process of innovation.

This system is likely to disproportionately benefit smaller firms because they would not need the legal resources to protect their patents nor to protect themselves against infringement suits. Also, the free access to copylefted technology is likely to be more of an asset to smaller firms that don't have the in-house capacity to negotiate contracts allowing for the use of patents held by other firms. While it may be a relatively simple matter for an Amazon or an Apple to work out a licensing arrangement to gain access to patented technology, this is likely to be a much more difficult process for a small start-up without a sophisticated legal department. For this reason, having ready access to the technology that is copylefted should be a major advantage.

An alternative to copyright monopolies

The clear path of copyright policy over the last four decades has been longer and stronger protection. Today, digital technology is posing a particular challenge. The law has been repeatedly adjusted to make it more difficult to use digital technologies and the web to reproduce material subject to copyright protection. In some cases technologies have

71 There is risk that law firms given the responsibility for enforcing copyleft patents could act like patent trolls. But the opportunities for public accountability and the option of non-renewal of contracts should limit this risk.

been blocked until effective locks could be developed to prevent unauthorized reproductions.[72]

Enforcement of protections for digital material has also meant imposing responsibilities on third parties. Recent laws require intermediaries to remove copyrighted material from their sites when they have been alerted by the copyright holders. A striking aspect of these laws is that intermediaries are liable if they do not promptly remove the material after being notified by the copyright holder; the intermediary is in effect forced to side with the entity making the copyright claim against its customer. The entertainment industry has also pushed measures to require intermediaries to proactively search their sites for unauthorized versions of copyrighted material.

This strengthening of copyright law and altering its structure to adjust to digital technology and the Internet is interesting not only because of the costs involved for the larger economy but also because it highlights alternative ways in which society adapts to technological change. Technological change has destroyed many sectors of the economy. The spread of digital cameras essentially destroyed the traditional film industry, causing the collapse of two major U.S. corporations, Kodak and Polaroid, and leading to the loss of tens of thousands of jobs. While the collapse of these companies and the job losses were unfortunate, no one would have considered it a reasonable strategy to block the spread of digital cameras.

On the other hand, when the development of digital technologies and the Internet threatened the business model of the entertainment industry, the response was to pass laws to contain these technologies to preserve the sector's mode of doing business. This is a great example of how it is not technology itself that is determining the distribution of income, but rather how various interest groups are able to write the laws governing the use of technology.

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72 There was a major debate in the 1990s around the introduction of digital audio recorders. In response to lawsuits, the major manufacturers agreed to include locks to prevent duplication of copyrighted material. See, for example: https://partners.nytimes.com/library/tech/98/10/cyber/cyberlaw/16law.html.

Like patents, copyright terms are protected by international agreements. However, it is possible to develop a comparable system or alternative funding to work around the copyright system. It is important that the system respect individuals' choices in supporting music, books, movies, and other types of creative work rather than having a government agency decide which work should be supported. For this purpose, an individual tax credit would be appropriate.

The model for a tax credit to support creative work could be the tax deduction for charitable giving. It allows individuals to make tax-deductible contributions to religious, educational, social assistance, and cultural organizations with minimum interference from the government. In effect, the government is subsidizing the contribution at the taxpayer's marginal tax rate, which is 39.6 percent for the highest-income taxpayers. Because the deduction is not capped, it is limited only by the size of the taxpayer's tax liability (i.e. it is not refundable).

To qualify for tax-deductible contributions, an organization need only file with the IRS and indicate the sort of tax-deductible activity in which it is engaged. The IRS does not attempt to determine whether an organization is "good" as a religious organization or as a provider of food to the poor; that determination is left to the taxpayer. The only concern for the IRS is that the organization is in fact engaged in the activity that provides the basis for its tax-deductible status and that it is not engaged in prohibited activities such as political campaigning or profit making ventures.

Eligibility to receive funds through a creative work tax credit would work much the same way. Individuals or organizations would register to be eligible to receive funds by indicating the type of creative work in which they engaged as individuals or supported as organizations. This means that individuals would indicate that they are writers, musicians, video producers or engaged in some other type of creative work. The only issue from the standpoint of the IRS (or any other enforcement agency) would be whether the person is in fact engaged in the activity and whether the organization used its funding to support the type of creative work it claimed to support. In other words, if an organization claimed to support the writing of mystery novels or jazz

music, then the concern would be whether they had actually used their funds for this purpose.

Because this system is intended to be an alternative to the copyright system, the condition for getting funding for both individuals and organizations is that they not would be eligible for copyright protection. In effect, creative workers would be given the option of relying on one or the other system of support. They could choose to rely on copyrights to support their work or they could opt to join the tax-credit system, but they could not do both. In order to ensure that the tax-credit system did not become a copyright farm system, in which people established their reputations in the tax-credit system and then cashed in with the copyright system, there should be a substantial gap (e.g., five years) between the last time creative workers received funding through the tax-credit system and when they could first receive copyright protection.

A convenient feature of this system is that it would be largely self-enforcing. A person who attempted to secure copyright protection on material for which he or she was not eligible would have the burden of suing the alleged infringer. Because there would be a registry of everyone in the tax-credit system, it would be a simple matter to show that the creative worker had been in the system too recently to qualify for copyright protection. In this case, there is no need for the government to do anything — it protects the integrity of the tax-credit system by doing nothing; the person does not have an enforceable copyright.

From the standpoint of individual taxpayers, the tax-credit system would specify a limited sum (e.g., $100) that they could give to individuals or organizations registered as eligible recipients. This means they could give their tax credit directly to a writer, singer, musician, or other creative worker that is in the system or they could contribute to organizations that are within the system and are committed to supporting particular types of creative work. Individual taxpayers would have the option to give the tax credit to a single individual or organization or divide it up among as many individuals as they choose. One major difference with the tax deduction for charitable contributions is that the tax credit would

be refundable, meaning that every person would have the option to support creative work of their choosing, even if they had no tax liability.

There would be some risk of fraud, just as there is with the charitable deduction. However, the risks are likely to be considerably smaller with the tax credit than with the charitable deduction because the sums involved per person would be much smaller. If a high-income person contributes $1 million to a bogus charity, he or she receives an effective tax subsidy of $396,000 that the charity and the individual could, in principle, split between them. A $100 tax credit would require 40,000 people to scam the government by the same amount.

A mechanism for preventing simple frauds would be to require a modest minimum level of funding for a person or organization to be eligible to receive any funds. Requiring that an individual has a floor of at least $3,000 and an organization of $10,000 would largely prevent simple trade-off arrangements whereby people agree to give each other their credits. Coordinated tax credit swapping might still be possible, but it would require a considerable amount of coordination, and therefore risk for a relatively small payout.

A credit of $100 opted for by 90 percent of the adult population (a high percentage, but this is free money) would generate more than $22 billion a year to support books, movies, music, and other creative work. This amount would vastly exceed the amount currently going to creative workers through the copyright system, although it would total far less than the current subsidy for charitable contributions, which is likely in the neighborhood of at least $54 billion in 2016.[73]

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73 The CBO estimated the size of this subsidy at $40.9 billion for 2006 (CBO 2011). Adjusting for the growth of the economy would put it at $54 billion in 2016. This is likely an understatement, since the tax rate for high-income taxpayers rose from 35 percent to 39.6 percent in 2013. As a result, a contribution of the same dollar amount would imply a substantially larger tax subsidy in 2016 than it did prior to 2013.

An issue that would naturally arise with this system is its scope. For example, should journalism be included as a type of creative work? [74] How about video games or software?

The logic of the system would suggest that the boundaries be drawn broadly, for two reasons. First, it would be difficult if not impossible to police the boundaries. If a person were being supported for writing non-fiction books but also posted weekly or daily pieces on the web on political events, would he or she be violating the rules if the system was not intended to support journalism? There would be a similar story with video games. At what point would interactive art become a video game? Do we want the IRS making this assessment?

The second point in favor of broad boundaries is that they would minimize the need for copyright protection. The goal of the creative work tax credit is to make a large amount of material available to the public that can be transferred at zero cost. Putting more material in the public domain in different areas is a positive benefit, as long as people value this work. The ultimate check on the boundaries of the system is what people are prepared to support with their tax credits. If few people opted to support journalism or video games, then these industries would remain largely dependent on copyright protection.

The special case of textbooks

Textbooks are an enormous expense for college students: households are on a path to spend more than $10.5 billion on them in

74 The Bureau of Labor Statistics (BLS) estimated the number of people employed as reporters in 2015 in print, broadcast, and Internet journalism at 44,360. The average annual pay was $50,700; the median was $37,700 (BLS 2016b). Fully supporting their pay through the creative work tax credit would require roughly $2.2 billion of revenue from the credit. Of course, newspaper and broadcast outlets require other support personnel as well. However, even in the absence of copyright protection it would still be possible to charge for print versions of newspapers or other publications and for advertising, even if the fees would be lower for material that could be duplicated.

2016,[75] or about $500 per student. The figure is even higher for full-time students. A single textbook can cost several hundred dollars, and renting one can cost $50–100 per semester. As with prescription drugs, most of this cost is attributable to a copyright monopoly.

Public funding could produce a large number of textbooks free from copyright restrictions. The arithmetic here is striking. An appropriation of $500 million a year (0.01 percent of federal spending) to finance textbook writing and production would cover 500 books a year, assuming an annual cost of $1 million per textbook. After 10 years, 5,000 textbooks would be available in the public domain to be downloaded at zero cost, or printed out in hard copy for the cost of the paper.[76]

In addition to offering enormous cost savings to students, this system would offer more flexibility to professors, who could combine chapters from different textbooks without the need for time-consuming and costly permission requests. Updating a textbook would be much simpler because there would no need to have a complete new edition to add one or two additional topics.

This is an area where long-term contracts with private publishers could work quite well. The contracts in this case, unlike prescription drugs, could be well defined. Publishers could specify how many books they intended to produce and the timeline on which they expected to produce them. Their ability to get subsequent contracts would depend on the quality of the work and the timeliness of the production. Because all information — the contract, the publication dates, and the books themselves — would be fully public, the problem of political favoritism should be minimized.

Furthermore, anyone could still produce textbooks under the copyright system. If the publicly financed texts proved to be inferior, few professors would use them. This competition would provide a clear market test of the quality of the publicly financed work.

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75 BEA (2016), Table 2.4.5U, line 67. This spending does not correspond exactly to college textbooks because it refers to "educational books," a category that can include some other books that are not college texts.

76 Because the funding might also be used to finance updates of existing texts, the number of discrete books published through this system might be somewhat lower.

Conclusion: Savings from alternatives to patents and copyrights

The prior sections suggested alternative mechanisms to patents and copyrights for supporting innovation and creative work in a variety of areas. While prescription drugs and medical equipment are almost certainly the most important area for alternatives to the existing system, there are many other areas in which the current patent and copyright system is likely posing a drag on economic growth. Switching to a system that relies on alternative mechanisms for supporting patents and copyrights could lead to substantial savings for households and businesses.

Table 5-6 shows projected 2016 spending and potential savings in areas where the costs of current monopolies are likely to be largest. Savings for recorded music and video material as well as recreational books are pegged here at 50 percent, under the assumption that the tax-credit system will make available a vast amount of free writing, music, and video material. Savings on educational books are pegged at 70 percent, under the assumption that the bulk of textbooks will be produced through the publicly funded system. The savings for prescription drugs are based on the calculation in Table 5-3. Savings in newspapers and periodicals, motion pictures, and cable TV are pegged at 20 percent. (With cable, many people may opt to rely on the Internet and cancel cable subscriptions.) The figure for medical equipment is loosely derived from the earlier calculation in Table 5-3; it is larger here because this figure reflects spending to purchase the equipment rather than the fees charged to patients. The total potential savings are $435 billion, or 2.4 percent of GDP.

The calculations shown in Table 5-6 are speculative, of course, because there is no way to determine in advance the effectiveness of an alternative funding mechanism to replace patents and copyrights. There are good reasons for believing that an alternative would be at least as effective, especially in the case of patents. The prospect of having fully open research, where the incentive is for dissemination rather than secrecy, would almost certainly lead to more rapid progress than the current patent system.

TABLE 5-6

Total savings from patent/copyright alternatives

(billions of 2016 dollars)

	Current spending	Potential savings
Recorded music and video material (line 42)	$30.8	$15.4
Educational books (line 67)	$10.5	$7.4
Recreational books (part of 90)	$30.2	$15.1
Prescription drugs (line 131)	$430.0	$315.5
Newspapers and periodicals (line 141)	$61.2	$12.2
Motion pictures (line 210)	$15.0	$3.0
Cable and satellite television and radio services (line 215)	$95.0	$19.0
Medical equipment and instruments (Line 6)	$94.0	$47.0
	Total	**$434.6**

Source and notes: BEA (2016), Tables 2.4.5U and 5.5.5U, and author's calculations; see text.

More importantly, bringing prices in line with production costs would offer enormous gains, especially in the case of drugs and medical equipment. It is difficult to understand the logic of paying for innovation at the point where a patient needs a drug or access to medical equipment. Monopoly pricing imposes an enormous burden on people at precisely the time when they are least able to bear it. A payment system should be structured to let patients and their families focus on getting well, not paying for their health care. No one would propose determining payments for firefighters when they show up at a burning house, but this is effectively what we are doing with patent monopolies in the medical sector. The absurdity is heightened by the fact that the ultimate payment is almost always a political decision, not a matter of consumer choice, so proponents of the patent system can't use the classic justification for market outcomes.

Weakening or eliminating patent and copyright support for innovation and creative work would radically reduce waste. In a market system, the best way to make profits should be to produce better products, not to run to court. But the patent system increasingly supports this second path to profits.

Economists have been successful in raising awareness about marginal cost pricing. The idea that consumers and the economy benefit

from eliminating tariffs and other trade barriers is widely recognized even if not universally accepted. However, the public is less aware of the much greater gap between prices and the cost of production as a result of patent and copyright monopolies. Economic theory tells us that the costs associated with this gap are enormously larger than the costs associated with the traditional trade barriers that remain. There is little reason to believe that the gain from the innovation and creative work that is induced by these forms of protection is remotely comparable to the costs, especially when considering the potential benefits of alternative mechanisms for providing incentives.