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THE INCENTIVE ARGUMENT IN PHARMACEUTICAL PATENT LAW

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Abstract. This paper critically examines the pharmaceutical industry and the incentive argument in patent law. It begins by framing an overview of the industry and patent law, focusing on U.S. and U.K. law, and multilateral agreements, and efforts by international organizations, such as the World Trade Organization (WTO). Next, the paper considers patent incentive arguments on both sides of the issue to provide a holistic and balanced perspective. It then views the longstanding debate through the lenses of contemporary issues related to Covid-19 vaccines and the recent patent waivers considered by many countries. This paper then provides informed opinions supporting the argument that intellectual property protection is core to innovation in the pharmaceutical industry, but patent waivers may be a necessary tool in certain situations. Lastly, it concludes by recommending fixing the TRIPS compulsory licensing provision flaws and carefully finding a TRIPS waiver solution that could strike the desired balance between protecting intellectual property (IP) and providing for the common good.

Keywords: Pharmaceutical Industry; Patent Law; Intellectual Property Protection; TRIPS Agreement; Patent Wavers; Innovation Incentives; Covid-19 Vaccines; Global Health Diplomacy.

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1. Introduction

The first vaccine to protect against a contagious disease was in 1796 after Edward Jenner inoculated a young boy with a mild cowpox virus and demonstrated immunity to the smallpox virus. In the early 1800s, smallpox vaccinations became widely accepted and gradually replaced the antiquated practice of variolation. Over the next century, smallpox diminished in North America and Europe, and in the second half of the 1900s, the World Health Organization (WHO) started a campaign to rid the world of smallpox. By 1977, the world had eliminated smallpox—a deadly and horrific disease that had killed over a half-billion people and disfigured and blinded billions more. The eradication of smallpox is one of the most outstanding achievements of humankind. Since then, vaccines have eradicated polio, diphtheria, mumps, measles, rubella and many other diseases.

While cowpox occurs naturally and cannot be patented by today's standards, what if it could have been patented?[1] Or, what if the novel process of inoculation was patentable? How would that have changed the outcome of global smallpox eradication? Undoubtedly, the outcome would have been different, but to what degree, we do not know.

Today, vaccines are not necessarily developed by a single trailblazing researcher using naturally occurring viruses but by corporations that invest tens of billions of dollars annually using high-technology and expert, multidisciplinary teams. In 2022, the pharmaceutical industry spent $224 billion[2] globally on research and development (R&D) (Mikulic 2023). To put that number into perspective, it is about the same as Qatar's annual gross domestic product (GDP).

These pharmaceutical companies undertake costly and uncertain research and development investment activities because of the drugs' potential to be commercially successful and make the company and its investors the required internal rate of return (IRR). Moreover, only about one in 1,000 drugs that enter pre-clinical testing are approved for therapeutic use, and for each drug that fails, it costs between $1 billion and $2 billion (Congressional Budget Office 2021, 2). These sunk costs are often recovered through the development and commercialization of successful drugs. Successful drugs can cost up to $3 billion, and the average time for Food and Drug Administration (FDA) approval is twelve years (U.S. Congressional Research Service 2020, 4).

The pharmaceutical industry relies on patents and the institutions that uphold patents, such as legal, regulatory, and political institutions, as its primary tool to protect companies' investments and subsequent revenue and profits associated with such development. Without these protections, the industry argues, companies would have less incentive to develop new, often life-changing or lifesaving drugs. The net effect would be less investment, less innovation, fewer new drugs, and, consequently, more disease and death. Opponents argue that the patent system perpetuates increasing healthcare inequality and protects entrenched incumbents. It is an exclusionary tool that provides unfair monopolies and hurts poor and underdeveloped countries—often places that need the medicines the most.

[1] In the 1800s cowpox vaccinations were changed to the vaccinia virus.
[2] All currencies are denoted in U.S. dollars unless otherwise noted.

This paper critically examines the pharmaceutical industry and the incentive argument in patent law. It begins by framing an overview of the industry and patent law, focusing on U.S. and U.K. law, multilateral agreements, and efforts by international organizations, such as the World Trade Organization (WTO). Next, the paper considers patent incentive arguments on both sides of the issue to provide a holistic and balanced perspective. It then views the longstanding debate through the lenses of contemporary topics related to COVID-19 vaccines and the recent patent waivers considered by many countries. This paper then provides informed opinions supporting the argument that intellectual property protection is core to innovation in the pharmaceutical industry, but patent waivers may be a necessary tool in certain situations. Lastly, it concludes by recommending fixing the Trade-Related Aspects of Intellectual Property Rights (TRIPS) compulsory licensing provision flaws and carefully finding a TRIPS waiver solution to strike the desired balance between protecting intellectual property (IP) and providing for the common good.

2. The Basis of Exclusion—Patent Law

Protecting intellectual property is an established practice that dates back to ancient Greece more than 2,500 years ago. However, the modern patent system started in the Republic of Venice during the mid-1400s. The Venetian Senate issued privilegi, essentially customary ad hoc patents to protect technological inventions, and established penalties for infringement (Stefania 2019, 111). Later, in 1474, the practice expanded to include statutory protections by passing the Venetian Patent Statute, which is regarded as the first Act of its kind (Stefania 2019, 105). This system operated for more than 300 years, granted about 2,000 patents, and transformed Venice from a maritime trading city to a centre of technological development in Europe (Stefania 2019, 141). Today, our patent system has significantly evolved from the early days of Venice, but the essence of the original system is the foundation for modern patents.

A patent is a self-enforcing exclusionary tool; it creates a limited monopoly preventing others from making, using, offering for sale, or selling (U.S. Patent and Trademark Office). A patent is a grant to an intellectual property right issued by a government authority, typically under a statute. Patent law has grown significantly in volume and complexity since the creation of the Venetian Patent Statute. It now consists of a mix of national statutes and laws, such as the U.K. Patents Act 1977 (as amended, 2004) and Title 35 of the United States Code, and international agreements, such as the European Patent Convention 1973 (amended 2000) and the WTO TRIPS agreement. Nevertheless, increasing effort is needed to set minimum international standards and harmonize national and international codification (World Intellectual Property Organization 2021).

In return for this temporary monopoly, the inventor must publicly disclose the invention for the common good in a way that is "full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains" (35 U.S.C. § 112(a), 1953). Inventors must determine if a patient is the best form of protection, weighing the pros and cons of patenting, including the cost, time, and complexity of gaining a patent. A common

alternative to a patent is a trade secret, which protects confidentiality and non-disclosure. Trade secrets also have protections under the law, although patents generally have more robust protections. Many companies have successfully used trade secrets far beyond what would have been the protection period under a patent, which is typically twenty years. For example, Krispy Kreme Doughnut has kept its recipe a trade secret for seventy years.

Patents are granted in the U.S. and U.K. for inventions that are novel (new), inventive (non-obvious), industrially applicable (useful), not excepted or excluded (discovery in nature, scientific theory, or mathematical method), and are adequately disclosed to the public (Thambisetty 2022, 40). Essentially, a patent is a private right in the public interest. Its existence is based on the following principles: Natural property right in one's own ideas, appropriation by others is stealing; justice requires society to reward an inventor for useful services rendered; the incentive to invest in securing industrial progress; and in the absence of patents, the inventor will keep invention secret (Thambisetty 2022, 16). This paper focuses on the incentive principle as it relates to pharmaceuticals.

3. A Profile of the Pharmaceutical Industry

The pharmaceutical industry is part of the broader healthcare sector and consists of drug manufacturers, drug marketers, and biotechnology companies involved with developing, producing, and marketing medications to prevent infections, maintain health, and cure diseases. The industry is highly regulated at both the domestic and international levels and pharmaceuticals are among the most regulated products in the world. This strict—sometimes described as "excessive"— conservative and evidence-based regulation is one of the leading reasons for the high cost of drugs (Hooper 2023). As a result, companies in the industry rely on patents as a critical tool to recuperate their investments from research and development and required regulatory approvals and to gain and maintain a competitive business advantage.

The pharmaceutical industry is giant; estimated revenues were $1.228 trillion in 2020 and are expected to reach $1.7 trillion in 2025 (The Business Research Company 2021). The U.S. is the world leader in pharmaceutical revenue, consumption, research, and development, hosting four of the top ten largest pharmaceutical companies (Pistilli 2023). The U.S. accounts for more than half of the world's pharmaceutical sales, and 80% of the U.S.'s drug sales revenue comes from branded drugs (non-generic) (AstraZeneca 2020, 14) and (IQVIA 2020, 33). Europe is second to the U.S. in each category, with a notable exception that it is the leading exporter of drugs—mainly to the U.S. market (Workman 2022). Switzerland, in particular, is a cluster of pharmaceutical activity, hosting the third and fourth largest drugmakers—Roche and Novartis (Pistilli 2023). It is also noteworthy that when measured as a percentage of GDP rather than in absolute values, Japan has the second highest spending on pharmaceutical research, approaching relative U.S. levels (Organisation for Economic Co-operation and Development 2017, 195).

China is currently the third-largest market but is projected to be the largest in ten years (Daxue 2023). China is also outpacing the U.S. and Europe in the number of patents

issued, and in late 2020, China significantly enhanced its pharmaceutical patents laws, allowing protection for partial designs, enhancing patent damages, and codifying preliminary injunctions (Allen & Overly 2020). There is little doubt that the emergence of China as a global pharmaceutical powerhouse and the strengthening of its pharmaceutical patent laws will dramatically shift the industry to a new era.

Both high R&D costs and substantial regulation are significant factors that lead to the $2.6 billion price tag to bring a new drug to market. Enormous expenditures on research and development are a common feature of pharmaceutical companies (DiMasi et al. 2016, 25). The pharmaceutical and biotechnology industry sector has the highest spending on R&D, with worldwide expenditures of over 15% of total revenue (EFPIA 2020, 10). The next highest sector is technology hardware and equipment, at about half of the pharmaceutical industry's expenditures—about 8 percent (EFPIA 2020, 10). In the United States, home to the world's largest pharmaceutical industry, spending on R&D as a percentage of revenue is even higher at 22 percent (PhRMA 2020, 4). Significant R&D expenditures are one of the primary arguments for patent protection by pharmaceutical companies.

In addition to research and development costs, strong regulation is a characteristic of the industry. Pharmaceutical laws and regulations ensure the safety, efficacy, and quality of the drugs available to the marketplace. Most governments have a pharmaceutical regulatory body to protect and inform citizens. In the U.S., the FDA, under the Department of Health and Human Services (HHS), is primarily responsible for ensuring pharmaceutical companies test new products for efficacy and safety (U.S. Food and Drug Administration 2023). There are also layers of complex and vast laws on top of regulation, such as the Drug Price Competition and Patent Term Restoration Act, informally known as the Hatch-Waxman Act.

The European Medicines Agency (EMA) performs a similar function to the FDA and is a decentralized body of the European Union (E.U.), headquartered in London, England (U.S. Food and Drug Administration 2022). However, a significant difference is that the EMA does not oversee all drug approvals in the FDA's centralized way. In Europe, a drug can be approved through four different channels depending on the drug class and manufacturer preference: centralized process, national process, mutual recognition, and decentralized process (Van Norman 2016, 401). The FDA traces its roots to consumer protection, and the EMA emerged out of a need to harmonize the regulations of twenty-eight different countries (Van Norman 2016, 399). In addition to domestic regulatory agencies, international bodies such as the WHO, WTO, Pan American Health Organization (PAHO), International Conference on Harmonization (ICH), World Intellectual Property Organization (WIPO) are some of the international regulatory agencies and organizations that regulate pharmaceuticals (Sengar and Tripathy 2012).

Mergers and acquisitions (M&A) are other common characteristics of the industry. Mergers and acquisitions date back to the industry's inception, with Glaxo, Wellcome, Beecham, and SmithKline each making between six and eleven significant acquisitions starting in the 1800s (Richman et al. 2018, 790). Since the 1980s, mergers and acquisitions progressively increased and transitioned from larger companies acquiring smaller companies to "blockbuster mergers," creating super companies. For example, the

Pfizer-Warner merger in 2000 was valued at $90 billion, which the U.S. Department of Justice (DOJ) attempted to but failed to block (Abdela et al. 2018, 5).

The literature is split on whether the industry's M&A activity increases prices or stifles innovation. However, M&A does increase consolidation, especially within narrow market segments. The Pfizer-Warner merger increased over-the-counter pediculicides Herfindahl-Hirschman Index (HHI)[3] from 2,223 to 4,024 (Abdela at al. 2018, 5). Some researchers believe that patent expirations are a crucial driver of M&A since larger pharmaceutical companies make fewer and less valuable discoveries, making incremental and duplicative innovations (Pammolli et al. 2011). Nevertheless, larger companies have the financing to complete downstream trials, which can be outside the reach of small firm budgets or even venture capitalists' deep pockets. It is not uncommon for acquisitions to occur before costly human trials, which have a medical cost of $27 million per clinical trial in the U.S. (Sertkaya et al. 2014, 4-2). Moreover, acquiring firms have the distribution and marketing networks to commercialize an approved drug successfully, which is often lacking in smaller firms. Therefore, many companies acquire innovation and add value in subsequent regulatory and commercialization processes.

The global and U.S. pharmaceutical industry has a low market concentration, comprising many small and medium-sized firms and is deemed competitive (Richman et al. 2018, 795). Overall, the industry had a global HHI measurement of between 500 and 700 over the past few decades (Richman et al. 2018, 795). However, the low HHI alone does not tell the whole story, as the HHI within each pharmaceutical category varies significantly, and much of that variation can be attributed to intellectual property rights. For example, global generic brand companies for all drugs have a very low HHI of 210, but suppliers of Alzheimer's treatment drugs have an astonishingly high HHI of 9801 (Abdela et al. 2018, 11). Since the generic pharmaceutical market segment is so lowly concentrated, it skews the Herfindahl-Hirschman Index, invalidating many antitrust and competition arguments; a more accurate consolidation assessment would be evaluating narrow market segments in pharmaceuticals.

4. The Pharmaceutical Industry's Use of Patents

The industry has a significant history and a particular interest in patents. The first drug patent in the U.S. was issued in 1796, only six years after the first Patent Act of the U.S. Congress was passed. Samuel Lee, Jr. of Connecticut, U.S., was issued a patent for a "composition of bilious pills," which mixed different combinations of extracts and claimed to cure "foul stomachs, where pukes are indicated" (Lee 1796). Lee went on to renew the patent several times, which may be the first case of the now-common

[3] A market with an HHI of less than 1,500 is considered low concentration and competitive, an HHI of 1,500 to 2,500 is moderately concentrated and competitive, and an HHI of 2,500 or higher is highly concentrated and least competitive.

"evergreen" practice in pharmaceuticals. Since then, drug makers have gone on receive thousands of patents on drugs.

Pharmaceutical companies view patents as a primary tool to protect the firm's investments and staunchly defend the patent system and intellectual property rights. As a result, most drugs have multiple patents, which is a "patent cluster" strategy where numerous patents are filed for the same product (Zafar & Lawrence 2014). In the U.S., the average top-selling drug has 125 patents submitted and 71 patents granted (IMAK 2018). Notably, one of the world's top-selling drugs—Humira—filed for 257 patents and has 130 patents issued in the U.S., which critics describe as an abuse of the patent system (IMAK 2019).

Most companies file crucial patents throughout a drug's development; however, it is not uncommon for many patents to be filed after a drug has received FDA approval due to the cost and time associated with gaining a patent. For example, Humira had 90% of its patents filed after FDA approval (IMAK 2019). Likewise, the five top-selling drugs in the U.S. had between 70% and 90% of their patents filed after FDA approval (IMAK 2019). Because of the high R&D spend and innovation coming from the United States pharmaceutical industry, U.S. companies file the most pharmaceutical patents. For instance, the European Patent Office (EPO) reports that U.S. companies filed 3,359 pharmaceutical patents in 2020. The next highest country was Germany, with 631 patents filed. The U.S. filed more pharmaceutical patents with the EPO than Germany, France, Switzerland, Japan, the United Kingdom, China, Korea, Denmark, and the Netherlands combined (European Patent Office 2020).

Since pharmaceutical companies rely on patents to maintain their competitive advantage over rivals, firms seek creative ways to extend these patents. A typical patent is valid for 20 years, with the exclusivity ranging depending on the type of exclusivity, jurisdiction, and statute. For example, in the United States, orphan drug exclusivity is granted for seven years, and new chemical entity exclusivity for five years (U.S. Food and Drug Administration 2021). Each year, dozens of drugs come off patent protection, representing potentially billions of dollars in lost revenue for the inventing firms. If pharmaceutical companies cannot gain patent protection extensions, these drugs will become available for generic manufacturing.

Since filing a patent requires disclosure, generic drug manufacturers have ample time to study the invention and make preparations to copy it. Most jurisdictions have a research exemption that allows generic drug makers an exception to the rights conferred by patents when used to perform research in preparing for clinical trials and regulatory submissions. For example, in the U.S., the Bolar Amendment of the Hatch-Waxman Act states, "It shall not be an act of infringement to make, use, offer to sell, or sell within the United States or import into the United States a patented invention... solely for uses reasonably related to the development and submission of information under a Federal law which regulates the manufacture, use, or sale of drugs or veterinary biological products" (35 U.S.C. § 271(e)(1)).

The amendment's scope was challenged to the Supreme Court of the United States (SCOTUS), when in 1995, the Court affirmed the broad scope of the law in Merck V. Integra. The Supreme Court acknowledged "a wide berth for the use of patented drugs in

activities related to the federal regulatory process," and the research exemption applies to "all (emphasis mine) uses of patented inventions that are reasonably related to the development and submission of any information under the FDCA" (Merck KGaA v. Integra Lifesciences I, Ltd., 2005). A similar provision made its way into the WTO TRIPS agreement in Section 30, Exception to Rights Conferred (World Trade Organization, n.d.).

As a result, the FDA approved fourteen generic versions on the day the patent for Bristol-Myers Squibb's Capoten expired (PharmExec 1998). Most drugs will transition from branded to generic, yet 307 drugs have come off patent and exclusivity in the U.S. and still do not have an approved generic (U.S. Food and Drug Administration, n.d.-a). While pharmaceutical companies that lose patent protection can no longer maintain dominant market positions and monopoly pricing power, the marketplace benefits from lower drug prices and more choices. When a drug moves to generic, the FDA reports that prices become 39% lower if the drug has a single generic producer and 95% lower if the drug has six or more generic producers (U.S. Food and Drug Administration, n.d.-b).

Some of the ways pharmaceutical companies maintain an extended drug monopoly include tactics such as evergreening, thicketing, product hopping, pay-for-delay settlements, and Swiss use claims (U.S. Congressional Research Service 2020, 1-2). Evergreening, commonly referred to as "lifecycle management" or "layering" by the pharmaceutical industry, is the common practice of artificially extending a patent or exclusivity by obtaining additional protections to extend the monopoly period for longer periods than would typically be permissible under the law (Feldman and Frondorf 2017). This practice usually involves incremental changes, such as new dosages, new form releases, new forms, and new combinations or variations (Moir and Gleeson 2014). Each time a secondary patent is granted for an "improvement" from the original one, that new one receives its own term (U.S. Congressional Research Service 2020, 9). Seventy-eight percent of new drug patents are not new drugs but existing ones that are evergreened; that translates to almost 40% of all drugs on the market (Feldman 2018, 595). These evergreened patents are typically incremental rather than innovative and offer little additional consumer benefits.

A related tactic for pharmaceutical companies to maintain a drug monopoly is thicketing. Thicketing is described as "a dense web of overlapping intellectual property rights that a company must hack its way through in order to actually commercialize new technology" (Shapiro 2000, 120). These thickets can involve filing several different patents on the same product to deter competition from entering the marketplace due to the risk of infringement and the high cost of litigation (U.S. Congressional Research Service 2020, 2). In 2017, the cost of litigating a lawsuit was $1.8 million in cases involving over $25 million in risk (Nayak 2017). Thicketing intends to fortify a single drug and deter competition through an insurmountable wall of patents.

Product hopping, sometimes called "product switching," is another practice the pharmaceutical industry uses to maintain dominance. In this case, the inventing pharmaceutical company proactively switches consumers and prescribing physicians from an expiring medicine to a new and similar medicine covered by a new patent (U.S. Congressional Research Service 2020, 20). If the company chooses a "hard switch," they

altogether remove the old medicine from the market; if they choose a "soft switch," companies keep the old medicine on the market along with the new medicine (U.S. Congressional Research Service 2020, 20). In a notable hard switch case, Abbott Laboratories v. Teva Pharmaceuticals USA, Inc, Abbott lowered the strength of its cholesterol drug, TriCor, switched it from a capsule to a tablet, stopped selling capsules, bought back excess capsule supply, and forced the marketplace to the tablet (U.S. Congressional Research Service 2020, 20-21). Critics of this practice argue that this anticompetitive behaviour kills the demand for a generic version of the drug before the patent expires and defenders of the practice say the practice is legitimate and promotes new and better products (U.S. Congressional Research Service 2020, 21-23). Moreover, the industry says inventing firms have no incentive to continue marketing and selling a product coming off of patent since 80% of sales will go to generics (U.S. Congressional Research Service 2020, 23).

Another industry tactic to maintain dominance is "pay for delay" settlements. When a generic drug seeks to enter the market before the patent expires, litigation issues can arise over patent validity and infringement (U.S. Congressional Research Service 2020, 28-29). Instead of litigating, parties will often enter settlements where the branded drug manufacturer will pay a generic drug manufacturer to delay entry into the market, allowing the original patent holder more time to charge monopoly prices (U.S. Congressional Research Service 2020, 28-29). The SCOTUS says that these settlements "can sometimes violate the antitrust laws" and have allowed antitrust litigation to proceed (Dunn 2019). However, in some cases, these settlements may benefit consumers. Such was the case when AbbVie settled with each company that intended to introduce a competitor to Humira. The result benefited the consumer as it allowed entry of the generics sooner than the expiration of the drug's secondary patents (BIOSIMILARS COUNCIL 2019, 8).

Swiss use claims are a feature of patent law that started in Switzerland and spread to Europe and parts of the rest of the world; it evolved to overcome issues recognizing new uses of known drugs (Warner-Lambert Company LLC v. Novartis (Singapore) Pte Ltd, 2017). Since methods of medical treatment are not industrially applicable and not patentable, the EPO made a technical exception to novelty, allowing the patentability of a process of manufacture for a new therapeutic use of a known substance (Thambisetty 2022a). Initially, the claim was valid for the first medical use, but the EPO later expanded this position, applying the exception to second and subsequent medical uses (European Patent Office 1984). Critics argued that Swiss claims were a compromised version of novelty. Later, the EPO modified its decision, and Swiss-type second medical claims will no longer be issued in Europe, although those previously issued are valid until 2031. Nevertheless, the practice continues in other parts of the world.

Each of these aforementioned exclusivity-extending tactics is legal and often used in conjunction with each other. However, companies that exploit the patent system illegally have been subject to antitrust charges. For example, in 2005, the European Commission (E.C.) found AstraZeneca had abused its dominant position of Losec, a drug to treat NSAID-associated gastric and duodenal ulcers. AstraZeneca made misleading representations by giving EPO the wrong market authorization date in an attempt to

extend its patents and was fined €60 million (Zafar & Lawrence 2014). In the United States, the Sherman Antitrust Act provides statutes for antitrust that apply to the pharmaceutical industry, and the Act is enforced through the Department of Justice (DOJ), the Federal Trade Commission (FTC), or lawsuits by private parties (U.S. Congressional Research Service 2020, 12-15). In Europe, each country has similar provisions developed from the European Commission's Articles 101 and 201 of the Treaty on the Functioning of the European Union (TFEU) (European Commission, n.d.).

The industry has also leveraged trade policy to help strengthen intellectual property protection to help fortify its position. The U.S. government has a vest interested in protecting the industry as it contributes to U.S. economic growth, provides high-quality employment, and pays significant taxes. The biopharma industry directly contributes 3.2% of the U.S. GDP, provides more than four million direct and indirect jobs, and workers paid $22.9 billion in personal income taxes (PhRMA 2019, 1). In Europe, several countries realize similar benefits, especially the United Kingdom, France, and Germany, where half of all Europe's biotech companies reside **(**Le Deu and Santos da Silva 2019, Exhibit 1**)**. Given the nature of the industry's centralized drug creation yet global demand and distribution, linking intellectual property standards to trade is an ongoing practice traced back to the 1980s during the acceleration of globalization (Sell 2003).

The WHO TRIPS Agreement is a noteworthy trade policy agreement related to international pharmaceutical intellectual property. TRIPS is one of the most significant international agreements concerning pharmaceutical intellectual property. Before its adoption, forty countries did not grant protection for pharmaceutical products (World Health Organization, n.d.-b). Today, the TRIPS Agreement provides strength and harmonization of IP among WTO members, and it specifies minimum standards for patents. In addition to more robust international IP protection of pharmaceuticals, the TRIPS Agreement was later amended via the Doha Declaration to allow flexibility and broaden access to affordable medicines in developing countries to control diseases of public health importance (World Health Organization, n.d.-a). Under certain conditions, the Doha Declaration provides members the right to grant compulsory licenses, allow parallel importation, and extend the least-developed countries' transition period (World Health Organization, n.d.-a).

As discussed in the previous sections, the pharmaceutical industry is uniquely complex and characterized by excessive research and development costs and high regulation at the domestic and international levels. The pharmaceutical industry relies on patents and the institutions that uphold patents, such as legal, regulatory and political institutions, as its primary tool to protect companies' investments and subsequent revenue and profits associated with such R&D and regulation. Firms attempt to utilize patents to their fullest extent, even engaging in legal but ethically questionable practices to maintain an extended drug monopoly using evergreening, thicketing, product hopping, pay-for-delay settlements, and Swiss use tactics. Without these protections, the industry argues, companies would have less incentive to develop new, often life-changing or lifesaving drugs.

5. The Arguments for Incentives in Pharmaceuticals

What motivates people to invent? The incentives argument for patents maintains that inventors must have intellectual property protection to give them the incentive to create their innovative works. This argument is grounded in economic incentive theory—the study of what motivates a person or a firm to behave in a certain way. Traditional economics espouses a rational-actor hypothesis that assumes people respond to incentives because they act rationally, optimally, and in their own self-interest (Amadae 2021).

Through these lenses, the pharmaceutical industry argues companies would have no incentive to develop new drugs unless patents, exclusivity, or some equivalent intervention existed. This is particularly the case in pharmaceuticals because, unlike most other products, pharmaceuticals are prohibitively expensive to develop but can be easily and inexpensively copied once developed and approved. Essentially, fixed costs are exceptionally high but the marginal cost to produce another unit, such as a pill, is remarkably low. Therefore, patent protection is more critical than other high-technology industries. The net effect of no or weak protection for inventors would be less investment, less innovation, fewer new drugs, and, consequently, more disease and death.

There is a general consensus among academics and, particularly, management practitioners that incentives do indeed work. Incentives are a powerful tool to motivate behaviour when designed and implemented correctly. The concept of incentives and acting in one's own self-interest was postulated by Adam Smith in The Wealth of Nations when he famously noted, "It is not from the benevolence of the butcher, the brewer, or the baker, that we expect our dinner, but from their regard to their own self-interest" (Smith 2002, 10).

More recently, a 2019 seminal study on incentives by Esther Duflo, a Massachusetts Institute of Technology (MIT) professor, won her the Nobel Prize in Economics. Interestingly, her study looked at vaccination rates in rural India and demonstrated how even small incentives had strong motivational power (J-PAL Policy Briefcase 2011). However, the question is not necessarily whether incentives work or patents are an incentive to invent in the pharmaceutical industry. Instead, the debate is more centred around the type and nature of the incentives and the balance of interests between the pharmaceutical companies and the common good.

Intellectual property exclusivity, primarily through patent protection, is a primary, if not sole, reason for pharmaceutical companies to invest so heavily in research and development of novel, risky drugs. Without them, or some equivalent mechanism, the research and development would not take place, argues defenders of the patent system. One of the prominent voices defending the pharmaceutical industry's position is F. M. Scherer, an Aetna Professor Emeritus at Harvard University's John F. Kennedy School of Government. Dr. Scherer is an economist with specialties in the economics of intellectual property and the economics of technological change; he also served as chair of the advisory panel for the U.S. Office of Technology Assessment's study of Pharmaceutical R&D: Costs, Risks, and Rewards (Harvard Kennedy School, n.d.). Through his research and writings, he reasons that enormous technological change fuelled by extensive R&D investment has been the most essential element of economic progress in the last century.

Dr. Scherer's research shows that despite the public's perception of industry profiteering, historically, pharmaceutical profits have been high but not "extraordinarily supra-normal profit returns" after considering several nuanced factors, such as risk and accounting practices (Scherer 2007, 30). After extensive evaluation of pharmaceutical companies' profits in the 1990s, the U.S. government concluded that once proper accounting and depreciation adjustments were made, pharmaceutical companies enjoyed returns on investment (ROI) only two to three percentage points higher than the cost of their financial capital (Pisano 2006, 114). Moreover, part of that excess is attributed to the riskiness of the investments (Pisano 2006, 114). A more recent study on the topic concluded with a more considerable discrepancy, finding that when research was properly accounted for, pharmaceutical industry returns were 8.3% versus a market average of 14.1 percent (Damodaran 2018).

A significant body of research shows that pharmaceutical research and development investments have yielded even lower returns in the recent decade, and companies are under increasing pressure to improve R&D productivity. In the 2010s, pharmaceutical companies made significant R&D investments, but returns fell from 10.1% to 1.8% (Ford et al. 2020). As a result, valuations and enterprise value (EV) fell during this timeframe, which was reflected in stock prices (Accenture 2017). The New York Stock Exchange (NYSE) Arca Pharmaceutical Index (DRG) experienced an average annual return of 2.0% compared to 7.6 percent for the Standard and Poor (S&P) 500 during that period (Yahoo Finance 2021). The DRG has consistently performed worse than index funds and technology industry peer groups since its inception in 1991 (Yahoo Finance 2021). For example, since the creation of the DRG, it has produced a return of 325%, while the broader Nasdaq Biotechnology Index (NBI) delivered a return of 1,680 percent (Yahoo Finance 2021).

Considering this historical context, a 2020 survey of sixty global biopharma company leaders rated research and development as the number one strategic priority for the next five years. The survey report went on to imply that "Biopharmaceutical leaders are under greater pressure than ever before, with the need to accelerate R&D innovation, adapt to a rapidly evolving health care ecosystem, and deliver on the expectations of society and their investors" (Ford et al. 2020) In light of these conditions and industry-wide concerns, the pharmaceutical industry's position that patents are critical to their business model and serve as a prime incentive to invest in new drugs is further bolstered.

Defenders of the patent system making the "research and development argument" also emphasize the link between drug revenues, research and development investments, and the discovery of new drugs. This nexus can be succinctly summarized in the research conducted by Dr. Joe Kennedy, former Chief Economist at the U.S. Department of Commerce and Senior Fellow at the Information Technology & Innovation Foundation, where he concludes through extensive research that "Academic studies consistently show that a reduction in current drug revenues leads to a fall in future research and the number of new drug discoveries" (Kennedy 2019). Research and development have a strong linear correlation to sales; for example, a 10% increase in sales increased R&D by 6% the following year (Golec and Vernon 2010, 17). This interconnection is also corroborated by similar research conducted a decade earlier by Dr. Scherer that showed a reduction in

R&D spending led to a reduction in new drug approvals (Scherer 2017). Drug prices, revenue, profitability, research & development, and new drugs are intrinsically linked and positively correlated.

Another argument regarding the pharmaceutical patent debate concerns global inequities and the common good. Since new drug development occurs in predominantly advanced, wealthy, first-world countries with strong intellectual property protections, many of those in need of drugs are in poor and least developed countries (LCD), where new, lifesaving, patented drugs are often outside the reach of those in need. Half of the world's population resides in countries where per capita income is only one-tenth that of the U.S and Western Europe (Scherer 2014).

The inequities and accessibility of critical, patented drugs played out over acquired immunodeficiency syndrome (AIDS) drugs in Africa, where new AIDS antiretroviral therapy (ART) initially cost $10,000 per year in 1989 dollars ($22,000 in today's dollars) (Hilts 1989). The industry believes that these countries benefit from the current system by eventually receiving these drugs at an affordable price rather than not. Today, these AIDS drugs cost $75 per year in Africa, and access to these drugs has fundamentally changed the continent (Rosenberg 2018). This allowed access to ARTs among human immunodeficiency virus (HIV)-infection people worldwide to increase from 570,000 in 2000 to 25.4 million in 2019, which is about the same number of persons living with HIV ("Global HIV Statistics" UNAIDS 2021). AIDS-related deaths in Africa have fallen from the leading cause of death to the fifth-leading cause of death, behind diarrheal disease ("Global Health Estimates 2019" World Health Organization 2021).

Some argue that poorer countries free-ride (from an economic perspective) because the entire cost of product development is borne by first-world countries, particularly the U.S. where consumers pay about 70% of all global patented biopharmaceutical profits (Kennedy 2019, 7). Each government's narrow self-interest is to set drug prices as low as possible and let consumers in other countries pay higher prices so drug companies can get their return on research and development investments (Hooper 2023). Although it would make economic sense for patent holders to engage in more substantial first-degree price discrimination (e.g., charging higher prices in richer countries and lower prices in poorer countries), the industry limits this practice for several reasons, including they are concerned with entrepreneurs accessing drugs in LDC markets and exporting them into first-world countries.

This arbitrage activity would be difficult to prevent in gray markets and would undoubtedly undermine the high prices pharmaceutical companies charge in first-world countries that recover R&D investments (Scherer 2014). It may also increase the flow of gray- and black-market counterfeit pharmaceuticals, which is outside the reach of the regulatory and enforcement processes and pose a public health risk. Supporters of strong IP protection also highlight that mechanisms, such as compulsory licensing, are now in place to allow poorer countries access to lifesaving, patented drugs during a public health emergency. They go further to express that many countries pursue policies that keep the prices of their patented drugs artificially and unnecessarily low and that if prices in these counties were raised, it would boost funding of R&D and all nations would benefit (Kennedy 2019, 20).

While the pharmaceutical industry and its proponents declare the exclusivity provided by patents is the primary incentive to invest and invent and are an indispensable component of a thriving industry praiseworthy of its world good, opponents opine those protections are not optimal, weighty towards the industry versus common good, and do not provide the incentive the industry claims—in fact, some even claim that patents deter innovation.

One of the significant voices against the patent argument for innovation is Dr. Eric Johnson, who graduated from Harvard Law and is a Professor of Law at the University of Oklahoma, specializing in intellectual property and antitrust. He postulates that a legal authority producing an artificial incentive only examines the extrinsic (external) motivations, not the intrinsic (inherent) motivations, and the extrinsic rewards are often unnecessary, particularly when an invention benefits society as a whole (Johnson 2012). Dr. Johnson admits that this argument seems counter-intuitive but provides evidence and data supporting it, mainly in the arts and creatives (Johnson 2012, 624).

Related to the pharmaceutical industry, he cites a survey revealing that about one-third of drug inventions would still have been introduced into the market without a patent system (Mansfield 1986)) . Nevertheless, this argument is unconvincing as two-thirds is still a compelling number, and the one-third could have utilized trade secrets to achieve the same end. Overall, his argument on incentives related to the pharmaceutical industry and research and development is weak; in fact, he admits that "multiple empirical studies confirm that patents are highly effective for appropriating gains only in certain industries....One of those industries is pharmaceuticals" (Johnson 2012, 663).

Some opponents of the incentives claim that external rewards, such as patents, can deter innovation and disincentivize creative labours (Johnson 2012). Michael Heller and Rebecca Eisenberg with the University of Michigan Law School describe this as an anticommons problem, "when multiple owners each have a right to exclude others from a scarce resource and no one has an effective privilege of use" (Heller and Eisenberg 1989, 698). Their central argument is not necessarily that patents are destructive to useful invention, but upstream patents create a fragmented, complex, and overlapping web of intellectual property rights that creates obstacles and bottlenecks to downstream inventions (Heller and Eisenberg 1989). While means exist for IP holders to coordinate and collaborate, such as licensing, these can be inefficient and stifle innovation due to heterogeneous interests among firms and high search, negotiation, and transaction costs (Heller and Eisenberg 1989).

A more nuanced view is that pharmaceutical patents incentivize but only in certain countries. Yi Quan, with Kellogg School of Management, Northwestern University, studied the effects of patent protection on pharmaceutical innovations for 26 countries that established pharmaceutical patent laws between 1978-2002 (Qian 2007). Dr. Quan showed that countries instituting patent protection on pharmaceuticals did not increase domestic pharmaceutical innovation. Only countries with "higher levels of economic development, educational attainment, and economic freedom" showed an increase. Dr. Quan notes that developing countries rely on imports as they do not have innovation potential.

Additionally, she concluded that there appeared to be an optimal level of patent protection that increased domestic innovation and anything over that discouraged innovation (Qian 2007, 450). However, Dr. Quan observed that implementing patent protection was positively correlated to R&D expenditure, and it had conditional effects on a country's innovation potential. Since most pharmaceutical innovation occurs in countries with higher levels of economic development, educational attainment, and economic freedom, her findings have little practical relevance.

6. Conclusion and Recommendations

After gaining a better understanding of patent law and the uniqueness of the pharmaceutical industry, this paper concludes that incentives do work and are a particular necessity in the pharmaceutical industry. However, this conclusion comes short of opining that the patent system is flawless, super-efficient, or fair; indeed, there is much room for improvement, and throughout the literature, researchers make suggestions on how the current system could be improved. Unfortunately, like many complex topics in law and public policy, the best solutions do not always come to fruition as they face practical obstacles to implementation, especially with complicated, obfuscated, political, and multi-stakeholder global issues with billions of dollars at stake. In short, the debate is less focused on incentives themselves and more centred around the type and nature of the incentives and the balance of interests between the pharmaceutical companies and the common good.

Suppose the threshold question is whether the current patent system balances pharmaceutical companies' equities and the common good. In that case, the argument becomes less weighty in favour of pharmaceutical companies, particularly when discussing lifesaving drugs during an epidemic or pandemic. Of course, how one defines "common good" may also affect the outcome as pharmaceutical companies and lawmakers in drug-developing countries may tend to have a more nationalistic definition while the rest of the world may have a more global definition. Regardless, this fundamental question could not be more relevant given the recent COVID-19 pandemic and the questions surrounding patent protections as the world struggles to vaccinate.

The question of incentives is of contemporary significance given the COVID-19 pandemic and the debate over decisions on equitably resolving vaccine access. As noted earlier, mechanisms exist in the TRIPS Agreement for compulsory licensing; yet, over six months after the first COVID-19 vaccines were approved, there had been little progress utilizing the TRIPS compulsory licensing provision for vaccines. This led many political leaders, including President Biden and sixty-one other countries, to support an unprecedented TRIPS waiver, which would temporarily lifted IP protections on vaccines. Only on June 16, 2022, did the WHO grant partial IP waivers on COVID-19 vaccines (WTO 2022). To make it easier for a foreign producer to get a compulsory license, the June 16 decision specifically abolished the requirement that foreign vaccine manufacturers apply for a voluntary license before applying for a compulsory license.

This delay and half-step measure was mainly because the TRIPS agreement has several deficiencies and limiting factors for use during pandemics and global public health crises (Access Campaign 2021). Since all 164 WTO member states must consent to a TRIPS waiver, the initiative was a challenging endeavour, and what many have seen as a failure may be a watershed moment for the WTO.

While this argument has many sides, including whether a waiver would achieve its desired goals of accelerating vaccine production and distribution due to tangential issues, such as supply chain and manufacturing resources, the argument of incentives is vital to the debate. Would the waiving of IP rights disincentivize pharmaceutical companies from further investing in COVID-related vaccines, drugs, and therapies? Would waiving IP rights limit the research and development of new drugs for future health needs beyond COVID? How would a waiver impact the greater health-technology industry, such as diagnostics and therapeutics?

Pharmaceutical companies generally oppose the waiver, citing the incentives arguments discussed in this paper. Stephen Ubl, president and chief executive of Pharmaceutical Research and Manufacturers of America (PhRMA) said, "This change in longstanding American policy... flies in the face of President Biden's stated policy of building up American infrastructure and creating jobs by handing over American innovations to countries looking to undermine our leadership in biomedical discovery" (PhRMA 2021). Moreover, vaccine-makers cite they are already providing "pandemic pricing" by selling at the vaccines at no cost or well below typical market pricing (Thambisetty et al. 2021). Yet, even at these lower prices, companies stand to make a COVID windfall; for example, Pfizer made $74.6 billion in COVID-19 vaccine revenue in 2021 and 2022 (Hopkins and Seal 2023). These windfalls are despite the fact that much of the development of the COVID-19 vaccine was provided with government funding or support—up to $40 billion from the U.S. government alone (Frank, Dach, and Lurie 2021).

In conclusion, patent protection plays a critical role in the health and vitality of the pharmaceutical industry. These protections provide incentives to increase R&D spending, resulting in more innovation and further pharmaceutical advancements of lifesaving and life-changing drugs. The impact of intellectual property protections is a net positive to the common good (global society). However, intellectual property waivers may be an appropriate and necessary tool during extraordinary human suffering when there is an immediate and extraordinary need for lifesaving drugs, such as during a public health emergency or pandemic. When implemented in a deliberate, targeted, and limited way, the rare implementation of such an act would have little impact on the overall incentives required to maintain a robust pharmaceutical industry during the course of regular business. This exception is especially true when much of the R&D burden falls on taxpayers and is provided by government subsidies. In collaboration with the pharmaceutical industry, significant work must be done at the WTO to fix the flaws in the TRIPS compulsory licensing and make provisions for patent waivers. However, thoughtful consideration should be given not to disturb the delicate balance between the equities of pharmaceutical companies and the common good—global humankind.

Additional details

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