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Assetization

Turning Things into Assets in Technoscientific Capitalism

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2 Patents as Assets: Intellectual Property Rights as Market Subjects and Objects

Hyo Yoon Kang

Introduction

Patents occupy a hybrid node in the entanglement of science, technology, and finance within capitalist economy and law. A patent, an intellectual property right creating a monopoly of twenty years, contains different proprietary modes in which an invention's potential may be materialized in social relations: via appropriation, possession, commodification, and assetization. These modes may not necessarily always overlap. This chapter describes and problematizes a specific turn to assetization that patents have taken: the transfiguration of patents into speculative financial assets. In light of the scholarship about the marketization and financialization of sciences (Nelkin 1984; Mirowski 2011; Birch 2017) and cultural studies of capitalization processes (Muniesa et al. 2017), I extend the question of patent value (Kang 2015) to examine the practices and mechanisms of valuation by which patents—legal property rights—are transformed into assets. I delineate the different ways in which patents are valued and acted upon as financial assets, which are premised on layers of legal and financial abstraction. Whereas it is well known that patents commodify, alienate, and eclipse their original referents—the inventions (Strathern 1999)—the analysis here shows that patents are enacted as real options in valuation practices and have been used as instruments of financial hedging. As a result, I argue that law itself is turned into a speculative financial asset.

The chapter focuses on the novel forms and practices that have turned the legal form of patents into speculative financial assets rather than offering an analysis of patents as legal techniques of commodification and monopoly rent-seeking. From the perspective of intellectual property law scholarship, the often-voiced criticisms against patents, that they exclude

production and labor from ownership and limit access to inventions through exclusionary practices and unfettered pricing, are not novel. Modern patents are monopoly rights that have been created to legally sanction such practices and effects. These criticisms nonetheless put the underlying justification of the patent system into question. This rests on the belief that a temporary monopoly promotes progress (e.g., US Constitution, Art. I, Sect. 8, Clause 8). A patent is expressly intended for the creation of a monopolistic market in order to reward inventive activities. This in turn is believed to generate more innovation in the long run (Schumpeter 1976). It is therefore neither new nor surprising that patents serve as mechanisms of generating monopoly rents on innovations (Birch 2017). That has precisely been the legislative intent of modern patent monopolies.

Intellectual property rights are often presumed to be valuable assets in the “knowledge economy” (UK Department for Business, Innovation and Skills 2016) or “intangible economy” (Haskel and Westlake 2018). Such an equation between patents as intangible assets and their value is assumed rather than explicated, or the precise nature of such a relationship queried. If patents are presumed to be valuable assets, then the question is what specific forms and material practices facilitate and enact patents’ assetization. In other words, what kind of assets *are* patents at this moment of financial capitalism, and what kind of understandings of market and law do the concrete assetization practices reveal? In common language, interdisciplinary literature of science and technology studies (STS), as well as in balance-sheet accounting rules, intellectual property rights are defined as intangible assets. However, it is not evident that patents are assets, or at least valuable assets, unless they are enlisted in specific modalities of value or acted upon in specific ways. The question of patents as assets is not only a question of nomenclature or a presumed derivative of contemporary political economy. But it entails a specific examination of the interaction of patents, which are abstract, generalized legal forms (Boltanski and Thevenot 2006, 8), with techniques of valuation and practices of transaction that enact their potential value. The effectiveness of patents as assets is utmost contingent on many legal formal requirements of representations and strategies (Menell 2018). It is also dependent on the availability and effectiveness of enforcement through litigation and remedies (Lanjouw and Schankerman 2001). Yet patents are turned into assets through practices and specific

knowledge techniques that are outside the “legal” realm. The aim of this chapter is to investigate some of these specific sites of patents’ valuation and their financial assetization.

It is helpful to tread carefully around vocabularies in order to differentiate what patents are and what they do. The following words in particular often become conflated in discussions about intellectual property: originality, creativity, knowledge, invention, innovation, patent, property, tangibility, and intangibility. The inherent hybrid character of these terms and concepts becomes purified in law (Latour 1993), and such rhetorical separations give rise to distinct realities, not dissimilar to the way in which economic models and business education literature perform certain kinds of economies (Muniesa 2014). For analytical differentiation, I hold on to the legal definition of a patent as an intellectual property right, which is essentially an abstract legal form exerting practical effects. This is not because I believe that the legal self-definition is a comprehensive or truthful one but because holding on to it allows me to distinguish and trace the legal form’s instability and contingency by interpreting it through the lenses of social theory and STS scholarship and delineating its various shapes as a result. Being attentive to these arbitrary, disciplinary, fictional, and material distinctions affords a better vision of what is at stake when patents are turned into and enacted as financial assets. It also allows for a differentiation between a specific financial logic of assetization in contrast to other modalities in which patents act as assets.

“When Wealth Lives Mainly in Intellectual Property”: Patent as Privilege, Property, Commodity, Asset

Patents were initially a privilege: they were granted not as a right but as a favor by the sovereign. One of the earliest sovereign patents was granted as a commercial monopoly for a useful invention in Venice in 1469 (Kostylo 2008). Patents were not transferable and were only intended for the person in use. An ensemble of abstract legal norms, infrastructure networks, and practices have been built in order to maintain and normalize the modern category of intellectual property as a legal property right, which can be possessed, used, transferred, exchanged, and sold. But this had not always been so, and there is no inevitable sense why a patent should be a property right

rather than an exception to the general rule of no special protection. There have been precedents of alternative intellectual property arrangements or a lack thereof: for example, the Netherlands abolished its patent system in 1869 and did not reintroduce it until 1912 (Moser 2005). Not so long ago, there have also been differences in national patent laws prior to the coming to force of the international system of intellectual property law via the Trade Related Aspects of Intellectual Property Rights (TRIPS) Agreement, backed up by the World Trade Organization. Historically Germany, as well India until 2005 when TRIPS had to be implemented, did not allow patents to be granted on products and thus promoted other ways to invent around an existing patent.¹

The modern rationale behind the creation of legal monopoly rights, such as patents, rests on the temporal postulates of *ex post* (reward for labor and investment expended) and *ex ante* (belief in incentivization of innovation by temporally restricted monopoly rights) effects of patent law. They incorporate the belief that the public encouragement of temporally limited private rent-seeking through patents is beneficial to the public. Much of the economic, policy-oriented, and economic history scholarship has been devoted to the evaluation of the long-term economic consequences of short-term monopolistic practices (Dasgupta and Stiglitz 1988; see Moser 2013 for an overview). Beyond the narrative of fostering domestic innovation for a vision of public good based on an economically competitive nation-state, economic historians have shown that much of the value of patents has been strategic and international in scope since the Paris Convention of 1883, which was the first attempt of an international coordination of patent policy (Bilir et al. 2011; Ricketson 2015). Patents remain prominent instruments of trade that can facilitate a commodity's market access or hindrance (Ryan 1998; Drahos and Braithwaite 2002). Although they are regarded as an alternative instrument of trade policy to tariffs, the effectiveness of patents as a trade instrument depends on their value and valuation (CBC News 2018). Recently some legal scholars have argued that the incentive-rationale of commodities trading of the international patent regime under TRIPS is increasingly coming into conflict with investment treaties in which patents are treated as investment assets rather than commodities (Dreyfuss and Frankel 2015). Such predominant ideologies and treatments of patent value are premised on the belief in free market and trade that separate asset value from the conditions of its production.²

These studies of patents as instruments of political economy may be helpful for understanding its current multiple jurisdictional layers and legal technicalities; however, they also risk reifying and ascribing a force to patents which they do not always have. Legal materialist approaches to the study of intellectual property rights have emphasized the contingency of these rights and legal forms, rather than understanding them as abstract rights that have uniform realities. As the essence of intangible knowledge has not been easy to capture, intellectual property law has instituted a web of legal forms (abstract property rights administered through a registration system, specific format and writing), uses (disclosure, ownership, possession, non-use, exclusion), and exchanges (through sale or licenses) to outline and thereby define the products of intellectual labor. Physical boundaries in land or the exteriors of buildings are visible but knowledge boundaries less so. The categories of intellectual properties in intangibles have been utmost materially choreographed and stabilized (Pottage and Sherman 2010; Kang 2012; Bellido and Kang 2016; Kang 2019). In the context of patent law, a patent's proprietary boundaries are determined by the textual boundaries of claims and the overall composition and intertextuality of a patent document (Myers 2005). The evolution of the modern patent law system of registration, disclosure, examination went hand in hand with the creation of a considerable administrative structure that established paper trails, textual rules, bureaucratic procedures, which were based on classification of knowledge (Kang 2012).³

Despite the contingent nature of intellectual property rights, a certain naturalized understanding of intellectual property spread to and was adopted by other domains of knowledge and values, which ascribed more and sometimes too little value to patents than they arguably actually had. This was not only a material effect of legal rhetoric (Edelman 1979) which eclipsed the original object of representation, the invention (Strathern 1999). The conflation of patents with value accelerated with different understandings of intellectual property as, on the one hand, a legal Schumpeterian instrument in a capitalist economy driven by innovation, and on the other hand, a problem of justice voiced by critical legal scholars who were concerned with the inequitable effects of TRIPS in particular, as well as scholars in anthropology and STS in the political economy of the biosciences.

In the body of interdisciplinary and critical scholarship on patents found in law, anthropology, and STS, there have been numerous analyses and

critiques of patent law as the central legal technique of commodification within the so-called knowledge economy. These concerns do not feature in formalist patent law scholarship because, from a doctrinal point of view, patents do not give ownership in knowledge. Patents cannot be granted for discoveries, principles of nature, or knowledge, but only for novel and useful embodiments of an inventive essence or for an inventive process. In an ideal world, the quality of the patent examination process would be high enough to adequately assess an application according to the formal and substantive patentability requirements: sufficient and enabling disclosure, novelty, non-obviousness, and utility. Yet as the 2013 US Supreme Court case of *Association for Molecular Pathology v. Myriad Genetics Inc.*⁴ has demonstrated, the boundaries of conceptual dichotomies underlying patent law's doctrinal principles, such as nature/artifice and persons/things, are stretched to the limits of their meaning in the context of biotechnology.

A reoccurring trope of concern has been the commodification of nature or knowledge, which ought not to be privately owned or enclosed, as well as the critique of the severance between the material circumstances of knowledge production and the abstract legal form of a patent. Critiques of legal techniques of commodification through intellectual property law have often employed the notions of public domain, commons and openness (Heller and Eisenberg 1998; Biagioli 2009; Boyle 2010). Patents have been characterized as turning nature and culture into market commodities (Coombe 1998) and establishing a barrier or blockage in the access to knowledge and medicines (Krikorian and Kapczynski 2010; Cassier and Correa 2014). In more concrete settings, anthropologists have depicted a complex picture of discourses and practices of intellectual property which complicate established dichotomies between private vs. public domains and openness vs. enclosure (Hayden 2003, Aragon and Leach 2008; Kelty 2008; Peterson 2014). Anthropological studies of biotechnology have highlighted the links between tropes of speculative finance capitalism and the intellectual property rights which go beyond a commodity market logic (Sunder Rajan 2006; Fortun 2008).

In contrast to such detailed critiques, the belief that “wealth mainly lives in intellectual property” (*Financial Times* 2017) has become a common parlance in management literature (Drucker 1969) and has been taken up by government and international organizations (UK Intellectual Property Office 2017). Intellectual property, particularly a patent, is seen as an asset

in a Schumpeterian understanding of the “knowledge economy” driven by a chain of disruptive innovations. Here intellectual property is understood self-referentially as both a driver of value creation as well as an indicator of innovation, the latter positively interpreted to be a determinant of economic growth and therefore assumed to be of value.

Such a circular view can also be found in discourses about the role of the university and the characterization of research and teaching in terms of their impact on the “knowledge economy.” The overlap between intellectual property and knowledge is assumed and not unpacked. An understanding of intellectual property as an asset, however, would need to be embedded in a diagnosis of the contemporary meaning of knowledge itself and its status within present configurations of economy (Raunig 2013; Lazzarato 2014). From the perspective of critical legal scholarship, the acquisition of facticity and naturalization of intellectual property are problematic because they ignore its constructed and contingent nature. Nonetheless this insight does not deny intellectual property’s rhetorical performativity and invocation of certain realities. Patent offices themselves call upon such a nexus of “innovation—economic growth—intellectual property” by reference to future potentiality: “Innovation fuels economic growth. There is evidence to show that more innovative markets are the ones that grow. This is true across the whole economy or individual industries, with the businesses in them measurably more productive. IP is important for innovation” (UK Intellectual Property Office 2017). Such a claim reflects a self-referential tautology: intellectual property drives innovation, innovation is necessary to create growth in the modern knowledge economy, and innovation is measured by the patent information, such as the number of patent citations, number of applications, and patent renewals.

Patent information has become valuable as an economic unit itself, for example, patent raw data are priced by the European Patent Office (EPO 2017). Economists have adopted the narrative of patents as assets by using patent data as an indicator of innovation (Griliches et al. 1987; Griliches 1990), as have scientometric methods (Leydesdorff 2004), and the measurement of the effects of academic research (Jaffe 1989). Qualitative survey data, however, has yielded a more complicated picture, which shows that the incentives for inventions are not always of a monetary nature (European Commission 2005). Nor has economic scholarship always taken patent quality into account, which can only be assessed by opening up the

patent document through textual interpretation rather than by patent data statistics. As indicators of patent value, economists have employed quantitative factors such as patent renewal (Pakes 1986; Lanjouw et al. 1998), rate of litigation (Lanjouw and Schankerman 1997), or patent citations (Trajtenberg 2002). The predominant strand of patent law scholarship employing law and economics methods has been inconclusive in its assessment of the overall benefits of the patent system for fostering innovation, but it identified many of what it regarded as the system's dysfunctions and pushed for its reform (Jaffe and Lerner 2006; Bessen and Meurer 2008; Burk and Lemley 2009). Patents continue to be regarded as something inherently valuable, although around 75 percent of patents are not useful in the sense that they are licensed out, referred to, or used (European Commission 2005). The above analysis reflects how the understanding of patents has changed from being primarily understood as assets rewarding inventors to key infrastructural assets for and within the "knowledge economy" (Kamiyama et al. 2006), a term that lacks a clear definition. The following sections describe the modes and practices in which patents act and are transacted as assets: patent portfolios, financial valuations, and market hedges.

Patent Portfolios: When the Intangible Is the Real

Patents contain distinctive modalities of value: they can denote a retrospective credit for work, act as currencies of credence, and serve as a financial security or an asset (Kang 2015). As industrial and business strategy, patents have been studied as strategic assets for the industrialization of knowledge, often crossing the dichotomy of pure and applied sciences, particularly in the life sciences and chemistry since the nineteenth century and used for gaining international competitiveness (Gaudilliere and Loewy 1998; Homburg et al. 1998; Steen 2000; Cassier 2005; Galvez-Behar 2016). The value of patents as assets derives from the projected exchange value of the patent as a property right rather than the actual or anticipated use value of the patented invention. The latter would be based on the terms of license, the individual contents of which cover conditions of use (exclusive, non-exclusive, time frame, one-off fee payment, or continuous royalty, etc.) and are negotiated within the bounds of contract law.

In contrast, the logic of patents as financial assets takes as its object the legal form of *property itself*: What is valued are not the potential licenses

and market size for the patented invention but the future return expected on the intellectual property right as a forward-looking investment vehicle (Risch 2013). In such a forward-looking financial logic, the black box of the legal form, the patent, is seldom opened up or evaluated in terms of its relative strength and quality. The investment logic expressly disconnects patent ownership from labor or the actual use of the patented invention by others. What matters in terms of a patent's financial asset value is the property right itself as a financial vehicle rather than the commercial potentiality of an invention.⁵ In controversies around "patent trolls," nonpracticing entities that buy patents with a view of obtaining a settlement or damages through litigation against alleged patent infringers, arguments against "free-riding" and the inequity of deriving profit from someone else's inventive labor have been voiced (Bessen and Meurer 2008). Treating patents as investment assets conflicts with the patent system's premise and justification that there is a balance to be struck between monopoly rights and the public interest in "the progress of sciences and useful arts." This utilitarian consideration is often referred to as the "patent bargain." There is, however, no discernible alignment between patent assetization and scientific progress; in fact, the financial assetization of patents seems to run counter to it (Tucker 2014). In order to ascertain whether treating patents as investments would be compatible with the legal narrative of a patent bargain, it would be necessary to assess their effects on the primary economy of production in terms of patent litigations initiated by the nonpracticing entities, the size of the litigated companies, and the damages awarded by the courts.

Recent transactions by operating companies indicate, however, that the so-called secondary or derivative market in patents *is* the primary market. The patent portfolio wars in the information and communication technology sector have radically destabilized if not completely dissolved the equation between primary market with tangible goods and secondary (or virtual) market with intangible products. According to Ocean Tomo, which tracks the value of intangibles in the stock market, the value of intangibles has overtaken the value of tangibles within the overall S&P market capitalization in the US. In 1975 more than 80 percent of corporate value reflected in the S&P 500 was attributed to tangible assets, while intangible assets comprised less than 20 percent of market capitalization. As of 2017, the ratio of tangible to intangible assets has inverted—nearly 80 percent of corporate value resided in intangible assets.⁶ Patent portfolios have become

separate, distinct assets, the value of which as a whole is deemed worth more than the sum of its constitutive parts. As Wagner and Parchomosky (2005) point out, companies will seek large quantities of patents as a portfolio rather than evaluating individual patents' actual worth.

Past high-profile transactions in the field of information technology have indeed valued patent portfolios as more desirable assets than the physical assets on which they were based. The premium placed on acquiring property rights, which gives power of control rather than production capacity, might be due to the patent thickets that have particularly been acute in technologies relating to smartphones and that have led companies to work around them through patent pools (Barnett 2014). In this particular sector, patents have been purchased as strategic assets, as arsenals in a 'war' of mutual patent portfolio containment directed at competitors. In 2011, Nortel, a large Canadian telecoms equipment manufacturer, filed for bankruptcy upon which a patent auction of its patent portfolio raised \$4.5 billion paid by a consortium of companies including Apple and Microsoft. Or when Google bought Motorola's patents in 2011 for \$12.5 billion, it was mainly interested in Motorola's phone technology patents, and sold off the smartphone business to Lenovo in 2014 for \$3 billion, effectively valuing Motorola's patents three times more valuable than the physical business. Another example, the demise of the venerable analogue film company Eastman Kodak was made even more poignant by the fact that the remaining value of the company was predominantly based on its intellectual property portfolio, particularly its patents portfolio, rather than its physical assets. It was reported that between 2008 and 2011 almost \$2 billion of Kodak's revenue was generated through licensing fees, royalties, and intellectual property related litigations and settlements. In 2012, 1,101 of its digital imaging patents were sold to a consortium of bidders, that included Google, Apple, Facebook, and Samsung, for \$525 million. The consortium was led by Intellectual Ventures and RPX, two prominent nonpracticing entities. Contrary to the perception that operating companies are at loggerheads with nonpracticing companies, the association and mixture of companies shows complex webs of overlapping interests and people between these companies, so much so that so-called operating companies also act as patent funds, patent brokers, and nonpracticing entities (patent trolls).⁷ For example, the founder of Intellectual Ventures, Nathan Myhrvold, had been the chief strategist and chief technology officer at Microsoft. It is a

chicken and egg question whether the patent arsenal buildup is a defensive or an aggressive strategy employed by operating companies in order to defend themselves against patent lawsuits from both their competitors, as well as trolls. What these past transactions indicate is that patents as property rights are the coveted primary assets rather than being merely seen as means of commodification.

Accounting for Patent Value versus Modeling for Patent Value

As Power (1992) and Sherman and Power (1994) have shown in the context of brand value accounting, a quantitative valuation of intellectual property involves a rematerialization of a legal potential (of a trademark or a patent) in a specific social context. The making of patents' "order of worth" (Boltanski and Thevenot 2006) has been accompanied by a call to better account for the value of patents. Quantitative models estimate the value of patents as intangible assets for accounting or investment purposes.⁸ Much of the reality of patents as financial assets is numerically articulated as the return on investment that is modeled on an Excel spreadsheet and acted upon in financial transactions. This section takes a look at some of the most commonly used quantitative patent valuation methodologies.

Patents have acted as collateral for capitalization, assets in a balance sheet, and as investment vehicles.⁹ These assetization practices require ascertaining a patent's monetary value. Different valuation methodologies can be used, depending on the purpose of the valuation, which may be balance sheet accounting, market transaction, or investment. The methodologies are, in turn, correspondingly based on parameters of cost, income, or market; or it can also involve real option pricing models. The last methodology could either employ the Black-Scholes equation or the binomial option pricing model (see Gilbert, this volume).

The valuation of intangible assets for the balance sheet is often much below a market valuation of a company as it is reflected in the share price. In 1999, a PricewaterhouseCoopers report listed two main methods of valuing intellectual property that it deemed suitable: income or cost-based methods. It excluded market-based valuation for patents because that would presuppose an existing market with comparables and the availability of sufficient public information. Given that novelty is one of the legal prerequisites for obtaining a patent, very novel patented inventions often do not have

market comparables. Also as licenses are private contracts, there is often a lack of reliable licensing information, particularly for unlisted companies. For these reasons, a market-based valuation approach was deemed insufficiently reliable. An income-based valuation was only suggested for active patents that already generated cash. For inactive patents with potential for future use, the 1999 report suggested a cost-based approach to patent valuation, which would be based on the projected cost of replacement—an exercise that would mainly capture the cost of filing for a patent but not an invention's future potential value. What is remarkable about the 1999 report is that its valuation methods categorize intellectual property as a commodity asset rather than as a financial asset. Intellectual property was to be valued on the basis of past earnings, excluding forward-looking estimates. As a result, it yielded conservative valuations.

Such a cautious approach to financial accounting stands in contrast to the forward-looking methods employed for company valuations or license valuations, often used for biopharmaceutical patents (see Roy, this volume). A valuation textbook puts it this way: "Start with the obvious. ... Intangible assets are worth a lot and accountants don't do a good job in assessing their value" (Damodaran 2006, 2). Most commonly, if a patent was already cash-generating, the discounted cash flow method would be used, which is based on projected income through licensing, royalties, or sale during the patent's lifespan and discounts it with a factor taken from patent holder's industry peers, hypothetically reflecting the riskiness of these future cash flows and the anticipated required returns on capital employed. This mode of valuation is speculative, especially before regulatory approval of a medicine or therapy, but companies use it widely for capital raising or loans. In 2012, the discounted cash flow method was reported to be the most commonly used method by so-called IP brokers (Ecoffier and Kasznik 2012).

Reflecting the future-oriented and speculative nature of patents as property forms, patents are increasingly valued using option pricing models. These have been seen as particularly apt for valuing patents that have been granted and do not generate cash flows—or not yet, but may potentially do so in the future. Valuation textbooks suggest to apply real option methods, such as the Black-Scholes model or binomial option pricing model, with a preference for the binomial option when asset prices are not steady (Damodaran 2006). The valuation of patents as real options implies that a patent is predominantly understood as a forward-looking, speculative asset rather

than as an embodiment of a commodity value. What is being valued as a real option is not the worth of a patented invention as a commodity, but the shell of proprietary right, the patent, which acts as a vehicle that transports a monopoly right into its potential market futures.

Market in Patent Monetization versus Market in Patents as Financial Assets

Together with these different modes of patent valuation, two types of markets have emerged with distinct operating rationales (MacKenzie 2006). There are first-order commodity markets in patent licenses, which are priced based on an estimation of future income stream of a patent (Gu and Lev 2008). These are markets aimed at the “monetization” of existing patents or patent portfolios, the value of which is otherwise seen to be idling around. They are either initiated by large patent holders themselves (e.g., IBM, Philips) or offered via an intermediary platform (e.g., the Intellectual Asset Management marketplace). The sales of patent portfolios as described earlier are examples of monetization, as the CEO and chairman of Kodak remarked after the patent sale: “This monetization of patents is another major milestone toward successful emergence” (*New York Times* 2012).

Differently from these monetization practices, I identify an additional kind of derivative market, which could be called second-order patent markets. These value patents on the basis of legal solidity and probability of winning adjudicatory disputes. The latter are typical of the patent troll business model of litigation threats and challenges of patent validity via an *inter partes* review at the US Patent and Trademarks Office. The difference between this kind of second-order market to the market in patent monetization is that the former identifies and values patents as financial investments (e.g., in patent portfolio funds, which treat patents as yields rather than commodities).¹⁰ Patents are also seen as assets for hedging and mediating risk. For example, the UK Intellectual Property Office webpage portrays intellectual property as a risk management and assetization strategy in order to maintain psychological or affective market “confidence” on a “fair” return on investment: “The system of interconnected IP rights, patents, trademarks, designs and copyright, reduces the risk of investing in innovation by ensuring that the results can be commercially exploited by the owner and protected from exploitation by others. With good IP

protection, innovators can be confident that they can make a fair return on their investment” (UK Intellectual Property Office 2017). Here, patents are characterized as affective assets in the financial market that extends beyond the original commodity market for an invention.

The difference between primary and secondary markets in patents as assets furthermore gives rise to different mechanisms of capital accumulation. In the primary markets for patents, the price of a patent license can be estimated by a discounted cash flow model. The reason for licensing-out a patent is based on a profit rationale which assumes that the license might yield a stable cash flow for a specified period for the licensor, or at least there is a potential for it to do so. The licensee would also have negotiated the use right—be it exclusive or not—with the view that some kind of business or economic benefit would be derived from it. The profit from royalties or license fees normally takes the form of rent: either in the form of a cut of the profits derived from the use of the patent, or a one-off license fee.

In contrast, the secondary market in patents is driven by price arbitrage, devoid of extracting rent or any other reference to the object of property right. The profit stemming from a secondary market does not necessarily have a link to the business of invention itself. The value of patents is based on arbitraging price margins, assessing the strength of legal claims language in the patent document, and speculating on the ability of the legal system to cope with the workload, courts’ interpretive inclinations, as well as their willingness to enforce the law. This is the business model of nonpracticing entities (patent trolls), which treat the legal property form as an asset of speculation rather than as vehicles of rent extraction via commodification. The effect of such an arbitrage is twofold: first, the specificity of inventions becomes less relevant to the creation of financial value; and second, the value is predominantly based on the legal form of the patent as a financial vehicle. The financial assetization of patents transforms abstract intellectual property rights into speculative investment vehicles.

Is the Turn to Assets New? Where Patents Act as Assets and Where They Don’t

One of the common criticisms about nonpracticing entities has been that they profit from other people’s efforts, reaping benefits of what others have sown. But that is exactly the point of an investment vehicle or security (Risch

2013). Knowledge products, such as inventions, are commonly regarded as being less alienable than other objects of property and are seen to possess a different quality than land or tangible objects. If one can speak of alienating knowledge at all, it could denote a lack of recognition through plagiarism (Biagioli 2014) or misattribution of credit by wrongful copying, but not because knowledge can be consumed away, depleted, or is rivalrous (Heller and Eisenberg 1998). Perhaps that is why, unlike in some other branches of property, patent holders are not expected to behave like intermediaries, such as real estate agents or asset managers. They are expected to act like owner-occupiers of a house rather than buy-to-let investors. Yet, despite the myth of the inventive genius (Israel 2000; Bracha 2005), patent law has long separated property ownership (including use and exchange) from inventive labor (Fisk 2009). From a legal technical point of view, there is no formal and ontological difference between real and intellectual properties, and indeed many of intellectual property law's materializations are governed by the same epistemological forms and material techniques, such as registration, documentation, for the inscription of proprietary boundaries as in the other branches of property law (Bhandar 2017).

The monetization and assetization of property rights are not new: trusts are as old as the English system of equity. Objects of real property, such as land and buildings, underlie a complex legal web of leases and licenses, as well as being able to be bundled into abstracted financial parcels such as real estate investment trusts (REITs). As there are secondary and virtual markets in real estate funds—a process of assetization based on property rights in physical objects—similarly, derivative markets in patents have grown and have become more visible. In the US over the last ten years, nonpracticing entities have been characterized as intermediaries, brokers, or middlemen (Hagiu and Yoffe 2013). The founder of the RPX, a patent risk management service, who acted as the former Goldman Sachs chief IP counsel, has described the aim of such intermediaries to “realize value” of dormant patents by treating them per se as assets (Zur and Squires 2015). The analogy between nonpracticing entities and real estate agents, however, becomes tenuous, as the latter arguably do not litigate against property owners or file for invalidity of a title at the land registry. Although the assetization of legal interests in the case of patents can be compared to the securitization of debt obligations, investment trusts, and real estate, they seem to be qualitatively different. Patents embody contingent, speculative, and

forward-looking potential, which is not always already realized and which has a temporal finitude of twenty years in theory. The financial assetization of patents amounts to a double speculation based on the abstractions of property and investment.

Attending to the distinct, internal characteristics of different knowledge practices allows drawing better distinctions between different modes of financialization and distinguish them from a commodity logic. Sherman and Powers (1994, 477) wrote that “both the very possibility of practice and the possibility of interaction between different fields are to be found in structures of knowledge and classification associated with each particular field.” An insight into such “structures of knowledge and classification” requires both inside and outside perspectives. Whereas an interdisciplinary perspective is useful for tracing complex problematizations, attentiveness to the internal logics and the specific rhetorical and material practices of knowledge structures, such as law or finance, can identify the texture of composition and dynamic of a problematization (Kang 2018). Legal, financial, and scientific knowledges may intersect in issues relating to patents, but also they may not always do so. A cross-disciplinary patent scholar needs to be as attentive to the lack of interactions as suspect overarching claims of co-production. In this particular context, it may require the unpacking of hasty analogies to diagnose the specific ways in which patents act as assets. Although the rhetoric of patent office, economists and political economists has the effect of naturalizing patents as assets, albeit maybe for different reasons, it is important to bear in mind that patents do not always turn into assets or into financial assets. Financialization also cannot be conflated with assetization, for there are other kinds of asset values that are not necessarily financial. Patents and financialization do not always go hand in hand. Below I delineate some recent controversies where patents did not act as financial assets.

Patents have been objects of contention in the scholarship on bioeconomies (Birch 2017). Although patents in pharmaceutical and biotechnological products have been implicated in the development of bioeconomies, the financial assetization of patents needs to be distinguished from other modes of financialization in biotechnology companies. Recent scandals surrounding Turing, Valeant, and Mylan (Glabau 2017) have in common that they were owned by vested financial interests that demand high returns: they all have, or have had, private equity or hedge funds as main

shareholders. One of the ways to increase return for these investors was by increasing the price of the product—by 5,000 percent in the case of Turing’s Daraprim. But this price hike was independent of patent protection, which had already expired (*New York Times* 2015). Another common way to increase the return on investment is to heavily leverage the company. This was the case with Valeant, which was in threat of default and under SEC investigation (*Financial Times* 2016b).¹¹

Patent validity shapes the pricing of patented drugs and company valuations, but so do a number of other factors, such as shareholder structure, debt-to-equity ratio, marketing, and distribution channels. Also, patents in this context are still operating as strategic business assets or as methods of cash generation, but are not necessarily primarily understood as *financial* instruments. Some of the most controversial recent price hikes were independent of patent protections, as in the cases of Mylan’s EpiPen or Turing Pharmaceutical’s Daraprim. EpiPen’s chemical compound was not patented, but it was linked to a patented delivery device, which arguably could be uncoupled from the compound itself. Patents on a medicine might have long expired, but the marketing and distribution channels might be closely controlled and inaccessible so that a generic substitute would struggle to find distribution or that a small patient number would be seen as not worthwhile to produce a generic for (Sunder Rajan 2011; Peterson 2014). These observations do not negate the fact that patents are used as exclusionary monopoly forces to extract profits by sometimes exorbitant prices that cannot be paid by patients and health insurance systems while advancing unsubstantiated justifications referring to research and development costs (Love 2012). The overlap between products of knowledge, their monetization, and the use of legal rights for financial motives understandably causes unease and worry. But careful analysis is needed to differentiate between situations where patents are, or are not, the exclusive mechanisms by which profits in the biotech-pharmaceutical industry are realized.

Hedging Law

I have distinguished between an understanding of patents as a source of profits via commodification and patents as financial assets, the value of which does not necessarily derive from the exploitation of an invention, such as a drug compound, but rather from a speculation about the solidity of the

legal property right itself. Treating patents as financial assets also entails a distinction between the value of the object of a property right (invention in the case of a patent) and the value of the property right (a patent).

Financial assetization of patents engages another level of abstraction on top of patent law's soft abstraction of inventive labor to an alienable commodity: law as the object of financial speculation. It is one thing to grant patent monopoly to a pharmaceutical manufacturer for the development of an antiviral drug. It is quite a different value proposition for patents to be implicated in a business model that encourages financial profits on the basis of speculating about the strength, demand, and enforceability of legal property rights and valued without much consideration of the original invention for which the patent is granted. In such a practice, the commodity to be traded and exchanged is not the invention; law itself becomes the asset and the commodity to go long or short on. The very operation of patent law becomes reconfigured as a matter of hedging for or against a patent's legal force.

The value of a patent as a financial asset is determined by hedging risk and time: projecting margins of stock price or company value fluctuations caused by a potential legal outcome. These hedges can consist in short-selling or going long on a company stock coupled with a challenge to an existing patent and estimating the level of damage awarded in litigation or a settlement in patent disputes. These considerations drive the threats of litigations of patent holders, both the business operations or nonpracticing entities who speculate on whether a patent right will be asserted by way of legal disciplinary power (e.g., a letter drawing on legal language or a threat of litigation), or through adjudication in the Patent Office, or by the courts. This has been apparent in the rise in applications for so called *inter partes* review at the USPTO, a process which was introduced by the America Invents Act in 2011. The *inter partes* review allows challenges to the validity of patents before the Patent and Trials Appeal Board (PTAB).

An example of the financial asset logic using the legal system as a market mechanism were the challenges against patents brought by the confusingly named Coalition for Affordable Drugs (CFAD), which consisted of hedge funds managed and owned by Kyle Bass, founder and principal of Hayman Capital Management LP. Bass brought thirty-six challenges to existing pharmaceutical patents. Bass argued that the purpose of the *inter partes* review applications was to make drug costs more affordable by invalidating

unjustified patents, while at the same time stating that there was nothing wrong as such in raising patent validity challenges with a profit motive:

The CFAD stated that “Celgene’s motion [the holder of the challenged patent] ... makes the curious argument that filing IPR petitions with a profit motive constitutes an ‘abuse of process.’ Yet at the heart of nearly every patent and nearly every IPR, the motivation is profit.... The U.S. economy is based largely on the notion that individual self-interest, properly directed, benefits society writ large.” (CFAD’s response, reported in Sidak and Skog, 2015, 124ff.)

The question of whether inventive knowledge should be seen as an origin from which profit and rent ought to be derived through layers of abstraction and intermediation is a normative one, and it cannot be neatly separated from the question of states of knowledge in financialized capitalist markets. Biotechnology has never been pure science (Thackray 1998). In *Biogen v. Medeva* (1996), one of the landmark cases in biotechnology patent disputes reaching the highest court in the UK, Lord Hoffman buried whatever remained of the belief in the separation between pure and applied sciences by stating that scientific progress need not be uncommercial in motives.¹² This juxtaposition, or a perceived alliance between science and commerce, has come a long way twenty years after *Biogen* and has morphed into a web of interests between technoscience and finance (Mirowski 2011).

Although Henry and Stiglitz (2010) have argued that challenging a patent is a “public good” because “there is an undersupply of public goods—implying that there will be too many patents granted because too few will be challenged” (Baker et al. 2017, 11), it is doubtful that shorting company shares by placing a bet on an adjudicatory outcome constitutes a “public good.” Kyle Bass’s financial vehicle, CFAD, contested the validity of thirty-six patents, eleven of which the USPTO dismissed outright as abuse of the institution. Seven applications for review were accepted, but they were not regarded as having significant financial value. By February 2016, Bass was reported to have returned most of the \$700 million that he raised for short-selling pharmaceutical stocks but maintained that “we have all the capital that we need to pursue everything to its logical conclusion at the patent office.... we are not stopping” (*Financial Times* 2016a). Bass argued that even if he was to short-sell patent holders’ shares and make profit from lower share prices, it would not be an abuse of process but rather contribute to market efficiency, referring to the reasoning of the Securities and Exchange Commission, which had stated that “short sellers who

short companies with overvalued stock can actually add to stock pricing efficiency by informing the market of the true economic value of those companies” (Sidak and Skog 2015, 125). The belief that the “true economic value” of the patents is reproduced in company share prices is reflected in index-tracking investment funds, such as the ones offered by Ocean Tomo. For example, the Ocean Tomo 300 Patent Index tracks the value of patents in a portfolio of three hundred companies that are deemed to hold the most valuable patents relative to their book value. It is said to have outperformed the S&P 500 from its inception up to 2015 by 1,620 basis points, which Ocean Tomo attributes to its emphasis put on patent valuation through “its proprietary Intellectual Property valuation methodologies,” according to its investments brochure.

Patents act as financial assets by linking financial hedges (measured by expected share price fluctuations) to legal decisions and outcomes. This practice is significantly different in its logic from other quantitative modelings of patent value. Here, value is enacted through a legal process of adjudication and not only through discounted cashflow valuation or option pricing models. The temporality in which value is seen to reside is also different. Valuing patents as real options is based on the premise that they are potentially valuable assets to possess in the future. Bass's patent validity challenges, in contrast, function by betting against the legality of past legal processes: they are speculations on the administrative and procedural strengths and weaknesses of the patent law system itself. Effectively this means that the patent law process—starting from the patent application and review process, to the robustness of the PTAB, the inclination of the Federal Circuit and the judiciary—is conceived and framed as a market in which financial value can be created. The legal form of a property right is unpacked and challenged as proxies of share prices. Patents are seen as proxy instruments for market-arbitrage. If one takes the SEC's claim of “true economic value” as an analogy, the question is whether these hedges will indeed make the patent system more efficient or whether such financial arbitraging of legal processes is incompatible with the functioning of the legal system itself, the rationality of which is based on norms than probabilities. Another way of reading this development could be that the free market premise on which modern patent law has been based has been realized to its full extent.

Conclusion: Patent Law as Market Subject and Object

Lazzarato (2014, 46) argues that the meaning of “intellectual” in capitalism has shifted from denoting a human mental capacity to the “‘intellectual’ and physical performance of machines, protocols, organization, software or systems of signs, science, and so on.” Whatever remains of the attribute “intellectual” in intellectual property in its transformation into a financial asset refers to itself: law as an assemblage of very specific knowledge techniques and practices. Going beyond the realization that assetization occurs, further analyses are needed of the concrete processes of assetization and their implications. The turning of patents into assets is not only a symptom of capitalization and assetization of technoscience with novel ways and degrees of speculative financialization. The assetization of patents represents a new frontier, a novel financial “innovation,” affecting a knowledge practice that hitherto had not been regarded as an object of speculation: law. Speculation about legal outcomes and decisions drives this novel financial asset.

The financial assetization of patents entails different modes of rationality and temporality than those of commodification. The rationality that drives patents’ financialization is probability (as opposed to monopoly), and its temporal mode is one of speculation (rather than of a recoupment, reward, or promise). The value of the patents as financial assets is neither measured by primary reference to the inventive thing itself nor by its surplus value as a commodity. Rather the value of patents as assets rests on the legal fiction of intellectual property and specific valuation practices, which vary in their techniques and settings, for example, as real options or by modeling short-sell hedges. The financial assetization of patents is an apt example of what Joseph Vogl (2010, 80) has called “capital’s credo,” the institution of a self-referential system in which the main referent is no longer a tangible good but an intangible mode of legal credit in the form of intellectual property right. Here the flow of exchange is no longer “good—legal credit—good,” but “money credit—legal good—money credit.”

The main referent in this transaction flow is neither the good of a commodity nor its original referent, an invention, but financial capital in search for the next yield. Free of tangible referents, illusions of value circulate and are effectively transformed into determinants of economic relations within the narratives of financial markets. To the double abstraction in patent law’s operation—conjuring an abstract legal right out of something which

is intangible, the inventive essence—another layer of abstraction is added: the one of financial assetization. These triple layers of abstraction reveal the legal system in its full contingency and its complex entanglements with the financialized economy. What is ultimately at stake is the financialization of the legal system itself. Legal forms have turned into financial assets. Whereas law institutes financial capitalism (Pistor 2014), here we see law being financialized itself. Financial capitalism has turned on its own constitutive foundation, law. Whereas law has enabled the creation of a market in patents as assets, but it has now become a financialized market object itself.

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Notes

1. See Sunder Rajan (2011) for the constitutionalization of intellectual property issues in the Indian Supreme Court and an overview of the different developments and regulations of the major patent law systems. Khan (2008) notes the German patent system's historical prohibition on the patenting of food, chemical, or pharmaceutical products.
2. Thanks to Kathy Bowrey for pointing out this underlying premise so clearly.
3. Modern patent law in the form of registration and examination as we know it has only existed arguably since the introduction of the Patent Act of 1836 in the US. The 1836 Act introduced the requirements of written specification, a predominantly text-based understanding of novelty and prior art reflecting the belief that there was a bargain to be struck between the monopoly right of a patent and the public interest to know about inventions through their disclosure in patent documents (Biagioli 2006).
4. 569 U.S. 576 (2013), https://www.supremecourt.gov/opinions/12pdf/12-398_1b7d.pdf.
5. This distinction often becomes muddled when patents are equated with inventions, as they are not the same. Patents and inventions are different entities: the former is a limited monopoly right, an intangible legal form, and the other is its object.
6. The Ocean Tomo 300 ® Patent Index (OT3000), <http://www.oceantomo.com/ocean-tomo-300/>. Ocean Tomo also runs an IP auction service, in which patents are auctioned online.

7. There is no clear dichotomy and alignment of interests between practicing companies that invent and license, on the one hand, and nonpracticing entities, who act like IP brokers or investors, managing IP as assets, on the other. Even university spin-offs, such as Oxford Sciences Innovation in the UK, act as IP management service, investment fund and incubator. Patent brokers such as IV and RPX, do not only act as intermediaries but also as principal investors in business with patents or as incubators. Straddling the private-public divide, France Brevet, is a government-backed IP broker and fund, reflecting a state-backed industrial policy through IP, as does Singapore IP Office, which stands in as the ultimate security for loans given for IP assets as collaterals. Other companies, such as Intellectual Ventures (backed by Google) have the business model of defensively purchasing patents in order to prevent NPEs from doing so and to challenge other NPE claims through *inter partes* review at the US Patents and Trademarks Office (USPTO).

8. For a general patent valuation overview, see Kamiyama et al. (2006) and PricewaterhouseCoopers (2007); for econometric use of patent renewal data for overall macroeconomic value of patents, see, for example, Pakes (1986); for option pricing model for individual patent as asset valuation, see Damodaran (2006, chapter 12) and Gu and Lev (2008).

9. For example, in Singapore, patents have been accepted as a collateral for cash loans from banks, but seem to be part of an industrial policy which is backed up by the government. See the press release from the Intellectual Property Office of Singapore (IPOS), <https://www.ipos.gov.sg/media-events/press-releases/ViewDetails/cash-for-intellectual-property-through-loan-financing-now-a-reality-in-singapore/>. Patents can be theoretically accepted as collaterals from banks, but this is rare due to the speculative nature of their valuation.

10. Well-known players offering patent funds are IV, RPX, and Ocean Tomo. Deutsche Bank and Credit Suisse had launched patent portfolio funds in 2008. The Deutsche one raised a total of around €300 million but filed for bankruptcy in 2010. Their short-livedness indicates that the assetization of patents is not entirely abstract and purely financial as in the case of REITs due to pricing intransparency in license transactions and the difficulty in comparing patent values.

11. Valeant had a junk bond credit rating in 2015. In 2016, it was recommended to file for bankruptcy. By March 2017, its shares had lost 95 percent in value since 2015. Valeant now still has a debt to equity ratio of 12/88.

12. [1996] UKHL 1, <http://www.bailii.org/uk/cases/UKHL/1996/18.html>.

References

Aragon, L., and Leach, J. 2008. Arts and Owners: Intellectual Property Law and the Politics of Scale in Indonesian Art. *American Ethnologist* 35 (4): 607–631.

- Baker, D., Jayadev, A., and Stiglitz, J. 2017. *Innovation, Intellectual Property, and Development*. AccessIBSA: Innovation and Access to Medicines in India, Brazil and South Africa, <http://ip-unit.org/wp-content/uploads/2017/07/IP-for-21st-Century-EN.pdf>.
- Barnett, J. 2016. *From Patent Thickets to Patent Networks: The Legal Infrastructure of the Digital Economy*. Working Paper 121: University of Southern California Legal Studies Working Paper Series.
- Bellido and Kang. 2016.
- Bessen, J., and Meurer, M. 2008. *Patent Failure: How Judges, Bureaucrats, and Lawyers Put Innovators at Risk*. Princeton, NJ: Princeton University Press.
- Bessen, J., and Meurer, M. 2014. The Direct Costs from NPE Disputes. *Cornell Law Review* 99 (2): 387–424.
- Bhandar, B. 2017. Registering Interests: Modern Methods of Valuing Labour, Land, and Life. In *Searching for Contemporary Legal Thought*, edited by J. Desautles-Stein and C. Tomlins, 290–311. Cambridge: Cambridge University Press.
- Biagioli, M. 2006. Patent Republic: Representing Inventions, Constructing Rights and Authors. *Social Research* 73 (4): 1129–1172.
- Biagioli, M. 2009. Nature and the Commons: The Vegetable Roots of Intellectual Property. In *Living Properties: Making Knowledge and Controlling Ownership in the History of Biology*, edited by D. Kevles and J.-P. Gaudilliere, 241–250. Berlin: Max Planck Institute for the History of Science.
- Biagioli, M. 2014. Plagiarism, Kinship and Slavery. *Theory Culture Society* 31 (2/3): 65–91.
- Bilir, L. K., Moser, P., and Talis, I. 2011. Do Patent Treaties Encourage Technology Transfer? Evidence from the Paris Convention, <http://ssrn.com/abstract=1893052>.
- Birch, K. 2017. Rethinking Value in the Bio-economy: Finance, Assetization, and the Management of Value. *Science, Technology, and Human Values* 42 (3): 460–490.
- Boltanski, L., and Thévenot, L. 2006. *On Justification: Economies of Worth*. Princeton, NJ: Princeton University Press.
- Boyle, J. 2010. *The Public Domain*. New Haven, CT: Yale University Press.
- Bracha, O. 2005. *Owning Ideas: A History of Anglo-American Intellectual Property*. SJD Thesis. Cambridge, MA: Harvard Law School.
- Burk, D., and Lemley, M. 2009. *The Patent Crisis and How the Courts Can Solve It*. Chicago: University of Chicago Press.
- Cassier, M. 2005. Appropriation and Commercialization of the Pasteur Anthrax Vaccine. *Studies in History and Philosophy of Science Part C* 36 (4): 722–742.
- Cassier, M., and Correa, M. 2014. Access to Medicines in Developing Countries: Ethical Demands and Moral Economy. *Developing World Bioethics* 14: ii–viii.

CBC News. 2018. Drug Patents Could Be Canada's Special Weapon in U.S. Trade Dispute, June 16, 2018, <https://www.cbc.ca/news/health/second-opinion-trade-dispute-canada-us-drug-patents-intellectual-property-1.4708630>.

Coombe, R. 1998. *The Cultural Life of Intellectual Properties*. Durham, NC: Duke University Press.

Damodaran, A. 2006. *Damodaran on Valuation*. New York: Wiley.

Dasgupta, P., and Stiglitz, J. 1988. Potential Competition, Actual Competition, and Economic Welfare. *European Economic Review* 32: 569–577.

Drahos, P., and Braithwaite, J. 2002. *Information Feudalism: Who Owns the Knowledge Economy?* London: Earthscan.

Dreyfuss, R., and Frankel, S. 2015. From Incentive to Commodity to Asset: How International Law Is Reconceptualizing Intellectual Property. *Michigan Journal of International Law* 36 (4): 557–602.

Drucker, P. 1969. *The Age of Discontinuity*. New York: Harper and Row.

Edelman, B. 1979. *Ownership of Image: Elements of a Marxist Theory of Law*. London: Routledge Kegan Paul.

Escoffier, L., and Kasznik, E. 2012. The Use of IP valuation in IP transactions: A Global Survey of IP Brokers. *European IPR Helpdesk Bulletin* (January-March, No. 4): 4–5.

European Commission, PatVal-EU Project. 2005. *The Value of European Patents. Evidence from a Survey of European Inventors, Final Report*, http://ec.europa.eu/invest-in-research/pdf/download_en/patval_mainreportandannexes.pdf.

European Patent Office. 2017. *Patent Information News 2017*, <http://www.epo.org/service-support/publications.html?pubid=132#tab3>.

Financial Times. 2015. Kyle Bass Plans Legal Action on Pharma Patents. *Financial Times*, January 7, 2015.

Financial Times. 2016a. Kyle Bass Returns Funds Amid Retreat on Pharma Shorting Campaign. *Financial Times*, February 23, 2016.

Financial Times. 2016b. Valeant: The Harder They Fall. *Financial Times*, March 28, 2016.

Financial Times. 2017. Big Tech Makes Vast Gains at Our Expense. Comment by Rana Foroohar. *Financial Times*, September 17, 2017.

Fisk, C. 2009. *Working Knowledge: Employee Innovation and the Rise of Corporate Intellectual Property, 1800–1930*. Chapel Hill, NC: University of North Carolina Press.

Forbes. 2016. Why Did Mylan Hike EpiPen Prices 400%? Because They Could. *Forbes*, August 21, 2016.

Fortun, M. 2008. *Promising Genomics: Iceland and deCode Genetics in a World of Speculation*. Berkeley, CA: University of California Press.

Galvez-Behar, G. 2016. Louis Pasteur, entrepreneur. Pour une histoire économique des mondes savants, <https://halshs.archives-ouvertes.fr/halshs-01267638v4/document>.

Gaudilliere, J.-P., and Loewy, I., eds. 1998. *The Invisible Industrialist: Manufacture and the Construction of Scientific Knowledge*. London: Palgrave Macmillan.

Glabau, D. 2017. Conflicting Assumptions: The Meaning of Price in the Pharmaceutical Economy. *Science as Culture* 26 (4): 455–467.

Griliches Z. 1990. Patent Statistics as Economic Indicators: A Survey. *Journal of Economic Literature* 28: 1661–1707.

Griliches, Z., Pakes, A., and Hall, B. 1987. The Value of Patents as Indicators of Inventive Activity. In *Economic Policy and Technological Performance*, edited by P. Dasgupta and P. Stoneman, 97–124. Cambridge: Cambridge University Press.

Gu, F., and Lev, B. 2008. Markets in Intangibles: Patent Licensing. *NYU Working Paper* No. 2451/27465.

Hagiu, A., and Yoffie, D. 2013. The New Patent Intermediaries: Platforms, Defensive Aggregators, and Super Aggregators. *Journal of Economic Perspectives* 27 (1): 45–66.

Haskel, J., and Westlake, S. 2018. *Capitalism without Capital: The Rise of the Intangible Economy*. Princeton, NJ: Princeton University Press.

Hayden, C. 2003. *When Nature Goes Public*. Princeton, NJ: Princeton University Press.

Heller, M., and Eisenberg, R. 1998. Can Patents Deter Innovation? The Anticommons in Biomedical Research. *Science* 280 (5364): 698–701.

Henry, C., and Stiglitz, J. 2010. Intellectual Property, Dissemination of Innovation, and Sustainable Development. *Global Policy* 1 (1): 237–251.

Homburg, E., Travis, A. S., and Schroeter, H. G. 1998. *The Chemical Industry in Europe, 1850–1914*. Dordrecht: Springer.

Intellectual Asset Management Magazine. 2008. Mixed View on German Patent Investment Funds. *Intellectual Asset Management Magazine*, March 28, 2008.

Israel, P. 2000. *Edison: A Life of Invention*. New York: Wiley.

Jaffe, A. 1989. Real Effects of Academic Research. *American Economic Review* 79 (5): 957–970.

Jaffe, A., and Lerner, J. 2006. *Innovation and Its Discontents: How Our Broken Patent System is Endangering Innovation and Progress, and What to Do about It*. Princeton, NJ: Princeton University Press.

Kamiyama, S., Sheehan, J., and Martinez, C. 2006. Valuation and Exploitation of Intellectual Property. *OECD Science, Technology and Industry Working Papers*, No. 2006/05. Paris: OECD.

Kang, H. Y. 2012. Science Inside Law: The Making of a New Patent Class in the International Patent Classification. *Science in Context* 25: 551–594.

Kang, H. Y. 2015. Patent as Credit: When Intellectual Property Becomes Speculative. *Radical Philosophy* 194: 29–37.

Kang, H. Y. 2018. Law's Materiality: Between Concrete Matters and Abstract Forms, or How Matter Becomes Material. In *Routledge Handbook for Law and Theory*, edited by A. Philippopoulos-Mihalopoulos, 453–474. Abingdon: Routledge.

Kang, H. Y. 2019. Ghosts of Inventions: Patent Law's Digital Mediations. *History of Science. Special Issue: Technologies of the Law/Law as a Technology* 57 (1): 38–61.

Kang, H. Y., and Bellido, J. 2016. In Search of a Trade Mark: Search Practices and Bureaucratic Poetics. *Griffiths Law Review* 25 (2): 147–171.

Kapczynski, A., Park, C., and Sampat, B. 2012. Polymorphs and Prodrugs and Salts (Oh My!) *PLoS ONE* 7 (12): e49470.

Kelty, C. 2008. *Two Bits: The Cultural Significance of Software*. Durham, NC: Duke University Press.

Khan, Z. B. 2008. An Economic History of Patent Institutions. *EH.Net Encyclopedia*, <http://eh.net/encyclopedia/an-economic-history-of-patent-institutions/>.

Kostylo, J. 2008. Commentary on Johannes of Speyer's Venetian Monopoly (1469). *Primary Sources on Copyright (1450–1900)*, www.copyrighthistory.org.

Krikorian, G., and Kapczynski, A. 2010. *Access to Knowledge in the Age of Intellectual Property*. Cambridge, MA: MIT Press.

Lanjouw, J. O., Pakes, A., and Putnam, J. 1998. How to Count Patents and Value Intellectual Property: Uses of Patent Renewal and Application Data. *Journal of Industrial Economics*, XLVI(4): 405–433.

Lanjouw, J. O., and Schankerman, M. 1997. Stylised Facts of Patent Litigation: Value, Scope and Ownership. *NBER Working Paper Series*, Working Paper No. 6297.

Lanjouw, J. O., and Schankerman, M. 2001. Characteristics of Patent Litigation: A Window on Competition. *RAND Journal of Economics* 32 (1): 129–151.

Latour, B. 1993. *We Have Never Been Modern*. Cambridge, MA: Harvard University Press.

Lazzarato, M. 2014. *Signs and Machines: Capitalism and the Production of Subjectivity*. Cambridge, MA: MIT Press.

Leydesdorff, L. 2004. The University-Industry Knowledge Relationship: Analyzing Patents and the Science Base of Technologies. *Journal of the American Society for Information Science and Technology* 55 (11): 991–1001.

- Love, J. 2012. *The De-linkage of R&D Costs and Drug Prices through the Prize Fund for HIV/AIDS*. Testimony at Hearing before the United States Senate, Committee on Health, Education, Labor and Pensions, Subcommittee on Primary Health and Agency on the High Cost of High Prices for HIV/AIDS Drugs and the Prize Fund Alternative, May 15, 2012, https://www.keionline.org/sites/default/files/testimony_JamesLove_15May2012_prizes_HELP_subject2revision.pdf.
- MacKenzie, D. 2006. *An Engine, Not a Camera: How Financial Models Shape Markets*. Cambridge, MA: MIT Press.
- Menell, P. 2018. Economic Analysis of Intellectual Property Notice and Disclosure. In *Research Handbook on the Economics of Intellectual Property Law: Vol. I, Theory*, edited by B. Depoorter and P. Menell. Cheltenham: Edward Elgar.
- Mirowski, P. 2011. *ScienceMart*. Cambridge, MA: Harvard University Press.
- Moser, P. 2005. How Do Patent Laws Influence Innovation? Evidence from Nineteenth-Century World Fairs. *NBER Working Paper Series*, Working Paper No. 9909.
- Myers, G. 1995. From Discovery to Invention: The Writing and Rewriting of Two Patents. *Social Studies of Science* 25 (1): 57–105.
- Muniesa, F. 2014. *The Provoked Economy*. London: Routledge.
- Muniesa, F., Doganova, L., Ortiz, H., Pina-Stranger, A., Paterson, F., Bourgoin, A., Ehrenstein, V., Juven, P.-A., Pontille, D., Saraç-Lesavre, B., and Yon, G. 2017. *Capitalization: A Cultural Guide*. Paris: Presses des Mines.
- Nelkin, D. 1984. *Science as Intellectual Property*. New York: Macmillan.
- New York Times*. 2012. Kodak to Sell Digital Imaging Patents for \$525 Million. *New York Times*, December 19, 2012.
- New York Times*. 2015. Drug Goes from \$13.50 a Tablet to \$750 Overnight. *New York Times*, September 20, 2015.
- New York Times*. 2016. Mylan Raised EpiPen's Price Before the Expected Arrival of a Generic. *New York Times*, August 24, 2016.
- OECD. 2009. *Patent Statistics Manual*. Paris: OECD.
- Pakes, A. 1986. Patents as Options: Some Estimates of the Value of Holding European Patent Stocks. *Econometrics* 54 (4): 755–784.
- Peterson, K. 2014. *Speculative Markets: Drug Circuits and Derivative Life in Nigeria*. Durham, NC: Duke University Press.
- Pistor, K. 2013. A Legal Theory of Finance. *Journal of Comparative Economics* 41 (2): 315–330.
- Pottage, A., and Sherman, B. 2010. *Figures of Invention: A History of Modern Patent Law*. Oxford: Oxford University Press.

- Power, M. 1992. The Politics of Brand Accounting in the United Kingdom. *European Accounting Review* 1: 39–68.
- PricewaterhouseCoopers. 2007. *Technology Executive Connections: Exploiting Intellectual Property in A Complex World*, <https://www.wipo.int/ip-outreach/en/tools/practice/details.jsp?id=865>.
- Pricewaterhouse Coopers, Zareer Pavri. 1999. *Valuation of IP Assets. The Foundations for Risk Management and Financing*, http://www.bvstrategy.com/Intell3_99.pdf.
- Raunig, G. 2013. *Factories of Knowledge, Industries of Creativity*. Cambridge, MA: semiotext(e)/Intervention, MIT Press.
- Ricketson, S. 2015. *The Paris Convention for the Protection of Industrial Property: A Commentary*. Oxford: Oxford University Press.
- Risch, M. 2013. Patent Portfolio as Securities. *Duke Law Journal* 63: 89–154.
- Ryan, M. 1998. *Knowledge Diplomacy: Global Competition and the Politics of Intellectual Property*. Washington, DC: Brookings Institution.
- Sherman, B., and Powers, M. 1994. Law, Accounting and the Emergent Positivity of Intangible Property. *Social and Legal Studies* 3: 477–495.
- Sidak, J. G., and Skog, J. O. 2015. Attack of the Shorting Bass: Does the *Inter Partes* Review Process Enable Petitioners to Earn Abnormal Returns? *UCLA Law Review Dis-course* 63: 120–155.
- Steen, K. 2000. German Chemicals and American Politics, 1919–1921. In *The German Chemical Industry in the Twentieth Century*, edited by J. Lesch, 323–346. Dordrecht: Kluwer.
- Strathern, M. 1999. *Property, Substance and Effect: Anthropological Essays on Persons and Things*. London: Athlone.
- Sunder Rajan, K. 2006. *Biocapital*. Durham, NC: Duke University Press.
- Sunder Rajan, K. 2011. Property, Rights, and the Constitution of Contemporary Indian Biomedicine: Notes from the Gleevec Case. *Social Research* 78 (3): 975–998.
- Thackray, A., ed. 1998. *Private Science: Biotechnology and the Rise of Molecular Sciences*. Philadelphia: University of Pennsylvania Press.
- Trajtenberg, M. 2002. *Patents, Citations, Innovations*. Cambridge, MA: MIT Press.
- Tucker, C. 2014. The Effect of Patent Litigation and Patent Assertion Entities on Entrepreneurial Activity, <https://ssrn.com/abstract=2457611>.
- UK Department for Business, Innovation and Skills. 2016. *Success as a Knowledge Economy: Teaching Excellence, Social Mobility and Student Choice*, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/523546/bis-16-265-success-as-a-knowledge-economy-web.pdf.

UK Intellectual Property Office. 2017. *Promoting Innovation and Growth. The Intellectual Property Office at Work 2016–2017*, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/653493/Innovation-and-growth-report-2016-17.pdf.

Vogl, J. 2014. *Specter of Capital*. Stanford, CA: Stanford University Press.

Wagner, R. P., and Parchomovsky, G. 2005. Patent Portfolios. *University of Pennsylvania Law Review* 154: 1–77.

Zur, E., and Squires, J. 2015. Why Investment-Friendly Patents Could Spell Trouble for Trolls, <http://knowledge.wharton.upenn.edu/article/why-investment-friendly-patents-spell-trouble-for-trolls/>.