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**PRICE DISCRIMINATION & INTELLECTUAL
PROPERTY**

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Price Discrimination & Intellectual Property

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This chapter reviews the law and economics literature on intellectual property law and price discrimination. We introduce legal scholars to the wide range of techniques used by intellectual property owners to practice price discrimination; in many cases the link between commercial practice and price discrimination may not be apparent to non-economists. We introduce economists to the many facets of intellectual property law that influence the profitability and practice of price discrimination. The law in this area has complex effects on customer sorting and arbitrage. Intellectual property law offers fertile ground for analysis of policies that facilitate or discourage price discrimination. We conjecture that new technologies are expanding the range of techniques used for price discrimination while inducing new wrinkles in intellectual property law regimes. We anticipate growing commentary on copyright and trademark liability of e-commerce platforms and how that connects to arbitrage and price discrimination. Further, we expect to see increasing discussion of the connection between intellectual property, privacy, and antitrust laws and the incentives to build and use databases and algorithms in support of price discrimination.

Keywords: Patents, copyright, intellectual property, price discrimination, antitrust, arbitrage, metering, sorting

JEL Classification: K20, K24, L11

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I. INTRODUCTION

This chapter provides an overview of the literature on price discrimination with special attention to the relationship between intellectual property rights and price discrimination. There are several reasons why a serious student of intellectual property law should understand the theory of price discrimination. First, although many IP owners practice price discrimination, these practices come in many guises that may not be apparent to a casual observer. For instance, patent licensors sometimes price discriminate across uses of the patented technology and in different geographic regions. Similarly, trademarks support product differentiation and brand loyalty in ways that often facilitate price discrimination. Trademark lawsuits have been used (not always successfully) to support price discrimination across geographic regions, or within aftermarkets. Price discrimination is also widespread in the market for copyrighted works. Movie tickets, magazine and book prices, computer software prices, and music performance licenses are subject to price discrimination strategies. Magazine subscribers pay much less than newsstand buyers, movie theaters offer cheaper tickets for daylight or mid-week showings, software is sold at a discount to students and educators, and establishments offering public music performances pay widely varying fees for identical blanket licenses. Second, price discrimination is becoming increasingly common in markets for digital copyrighted works (Shapiro and Varian, 1999). Third, intellectual property laws influence the profitability and practice of price discrimination in many ways. As we will demonstrate below, intellectual property law offers unusually fertile ground for analysis of policies that facilitate or discourage price discrimination.

Roughly speaking, price discrimination occurs when a seller sets more than one price for a good or service. More precisely, Stigler (1987) specifies that price discrimination arises when the ratio of prices differs from the ratio of marginal costs for the products offered by a seller.¹ Price discrimination is evident, for instance, to air travelers who may find the passenger next to them paid a different price to travel the same route. Price discrimination is less evident when the price for two products is the same but the marginal cost of providing them differs, or when multiple products are sold together, or when differentiated products are offered at prices that diverge from the ratio identified by Stigler. In what follows we consider various strategies used by IP owners to achieve price discrimination.

We keep formal economics to a minimum and recommend Stole (2007) to readers seeking a more comprehensive and rigorous review of the price discrimination literature. Readers may also find the chapter by Christopher Yoo on product differentiation in this volume to be a helpful complement to this chapter, because sellers sometimes differentiate their products to discriminate across different market segments.

II. PRICE DISCRIMINATION: OVERVIEW

Successful price discrimination relies on sellers *sorting* buyers in terms of willingness to pay; those willing to pay more are charged more. Discrimination will not succeed if the disfavored buyers can make purchases from, or otherwise gain access to products that

¹ Price discrimination is challenging to define. Prohibitions of price discrimination in antitrust laws provide an implicit definition. Antitrust laws generally operate on the intuitive notion that price discounts are discriminatory when they are not justified by cost differentials. Such a definition does not match up well with the economist's definition of price discrimination (Baker, 1997, pp. 177-ff.). Economists point out that charging a uniform price can also be discriminatory, (e.g., when delivery costs vary, a uniform delivered price discriminates in favor of distant customers) and that product quality or other differences between sales should be accounted for in the definition.

are sold at a lower price to favored buyers. Thus, a price discriminator must block *arbitrage* that could erode the price differential between favored and disfavored buyers. This Section outlines the various forms of price discrimination, using examples drawn from markets in which intellectual property often plays an important role.

A. Pigou's classification

Pigou's (1932) classic description of price discrimination distinguishes three practices.

In **third degree** price discrimination, price differentials are tied to a characteristic of a buyer that is correlated with the buyer's valuation.² For instance, movie exhibitors offer senior discounts and thereby use the age of the buyer to discriminate. They assume that senior citizens have a weaker demand than other buyers do. This practice requires that sellers can observe buyers' characteristics.

In **second degree** price discrimination, the price differentials are tied to the choices by the buyer. The pattern of discrimination reflects the seller's belief that a certain choice will be made by a low valuation buyer and a different choice will be made by a high valuation buyer. For example, movie exhibitors offer a discount for Tuesday movies to sort between movie patrons who are flexible about when they see a movie and those who are not. This hidden characteristic of flexibility is supposedly correlated with less intense demand for movies. Second degree price discrimination is used when a seller cannot directly observe buyers' characteristics.³

Overall, sellers may care about a mix of observable and hidden buyer characteristics and may engage in second or third degree price discrimination or a mix of the two.

In **first degree** price discrimination the seller knows or learns the exact valuation of all buyers. This of course is an idealized benchmark.

B. Product differentiation and second degree price discrimination

The movie exhibitor in our senior discount example of price discrimination offered every buyer an opportunity to see the same movie, but at different prices. Implicit in Stigler's definition of price discrimination is the possibility of a price discriminator that offers two or more versions of its product for sale. Offering multiple product versions

² Third degree price discrimination does not always depend on variable characteristics like age. It can also depend on buyer attributes that cannot be changed easily. Textbook publishers discriminate between college and other bookstores. Movie distributors discriminate based on the size and location of a theater. These attributes reflect past choices of buyers that will not be altered just to avoid price discrimination.

³ The standard treatment of second degree price discrimination from information economics studies the characteristics of an optimal pricing mechanism and product design choice for a monopolist facing two types of customers. One type of customer has a higher marginal valuation of quality than the other. The results show that the socially optimal quality is offered to the high valuation customer. The low valuation customer is provided with quality that is less than the social optimum. Furthermore, the low valuation customer is left indifferent between participating in the market or not. The high valuation customer gains positive surplus. Since the seller cannot distinguish high and low valuation customers he or she has to offer one price and quality combination that attracts one type of customer and another combination that will attract the other type. An artful choice of quality and price pairs solves both the arbitrage and measurement problem. The high valuation customers prefer higher quality despite the higher price; the low valuation customers prefer lower quality and price. If the seller could distinguish high and low valuation customers and practice third degree price discrimination, then the seller would choose the socially optimal quality level for both types of customers. Under second degree price discrimination the quality is degraded to low valuation customers to make it easier to sort the two types. When the quality gap is large, the seller can raise the price differential and gain a higher mark-up from the more profitable market niche containing the high valuation customers.

may increase the profitability of second degree price discrimination. Price discrimination occurs when the seller marks up the price of one version (over marginal cost) more than the other. Thus, sellers may combine price discrimination and product differentiation. The price discriminating seller allows customers to choose the high quality or low quality version of the product and sort themselves into a high value segment and a low value segment (or possibly multiple segments if there are more than two products offered).

Products can be differentiated in many ways. The term vertical product differentiation is used to describe products that range from low to high quality, e.g., limited and full-feature software. The term horizontal product differentiation is used to describe other types of product differentiation in which buyers have different preferences over different products' attributes. It is easy to see that vertical product differentiation may be helpful for sorting buyers into high and low value segments. Horizontal product differentiation may likewise be helpful in sorting if higher valuation buyers happen to prefer a particular set of attributes. Movies exhibited at noon may be more valuable to some customers than movies exhibited in the evening, but most customers prefer the latter, and form the high value segment that typically bears the higher price.

Different physical attributes can be used to differentiate products, but products can also be differentiated in terms of delivery date, quantity, and contractual restrictions.

Delivery date differentiation is used frequently in markets for copyrighted works, such as movies and books. A movie viewer can choose between a first-run or second-run showing in the theater, DVD sales, pay-per-view, premium cable, streaming services, free cable, or free broadcast. Similarly, the price of novels declines over time. Eager readers pay a higher price for hard cover books, and more patient readers wait for the later publication of the cheaper soft cover version. For both movies and novels there are quality as well as timing differences that roughly correspond with the price and release date. Viewing quality is higher in a theater than on television, and first-run theaters are usually more pleasant than second-run theaters. Pay-per-view, premium cable, and videotapes do not have commercials. Hard cover books are more durable, more attractive, and have larger print. The price of these choices usually declines with the viewing date. No arbitrage is possible. Buyers cannot buy cheap and travel back in time to sell the item at a premium. Similarly, software is often offered at a lower price when subjected to consumer or educational use restrictions, while identical software without those restrictions is sold at a higher price. Patent licenses often entail price differences depending on the type of use, include geographic use restrictions, single or multiple uses, or with or without resale rights.

Note that arbitrage is not possible if the products are differentiated by physical attributes. Arbitrage is possible however against quantity restrictions if a portion of a purchase can be resold. Arbitrage is possible also when differentiation is created through contract terms — by violation of the restrictions. For example, a buyer might violate an educational use restriction on software by using the software for business tasks. Alternatively, such a buyer might resell it to a business user.

C. Differences between second and third degree price discrimination

Three main principles are paramount to an optimal second degree price discrimination strategy. First, prices respond to marginal cost. If the product with the more attractive attributes is costlier, then its price should be higher. This relationship between price and marginal cost applies whether or not a seller price discriminates. Second, market power allows a seller to mark-up prices above marginal cost. A price discriminating seller is

especially interested in marking-up the price to the high valuation segment of the market. Third, prices are subject to a *sorting constraint*. If a seller is too aggressive and selects an excessive mark-up for the more attractive product, then high valuation buyers will switch to the other product. The sorting constraint keeps the difference between the two prices small enough so that buyers will sort themselves.

Note that there is a tension between the second and third principle. The profitability of second degree price discrimination is limited because the sorting condition restricts the mark-up that can be levied against the high valuation buyers. The sorting constraint does not apply to third degree price discrimination however, since the buyer characteristic used for sorting is observable to the seller. Thus, third degree price discrimination is more profitable given the superior information available to the seller, all else being equal.⁴

Besides the sorting constraint, the two forms of price discrimination also differ in terms of their relationship to arbitrage. Resale can be used to arbitrage against both types of price discrimination.⁵ But with second degree price discrimination there is an additional method of arbitrage; a low-price buyer can engage in *personal* arbitrage. Personal arbitrage means that the buyer recovers some or all of the benefit of the high-priced product by “modifying” the low-priced product. For instance, sophisticated buyers may circumvent technology that limits how a product is used — e.g., refilling printer cartridges or modifying software to unlock restricted features. Such uses and modifications by buyers may violate license terms or intellectual property rights. If the violation is undetected, however, then the buyer gets the benefit of a low price and unrestricted use.

D. Tying, merchandising, and bundling

Sellers can also implement second degree price discrimination by bundling or tying products together, or simply through the exclusive right to sell complementary products. Specifically, *tying* arises when a seller conditions the sale of one product or service (the tying good or service) on purchase of a different product or service (the tied sale). Some of the most prominent tying disputes in antitrust law involve patented products.⁶ Also, much of the case law involving the doctrine of patent misuse involves tying. *Bundling* arises when a seller sells products X and Y as a bundle but not separately (at least for certain customers). Bundling of content by media companies and multiple software products by software publishers is common and sometimes controversial. *Merchandising* refers to the sale of relatively low value products that are complementary to a high value copyrighted work, franchise or a high value trademark. Sports teams sell hats, T-shirts etc. Movie copyright owners sell toys, posters, etc.

⁴ This comparison holds if arbitrage is not possible. The comparison may be reversed if arbitrage is more difficult to control under third degree price discrimination compared to second degree.

⁵ Many copyrighted products subject to second and third degree price discrimination are services. Resale is difficult or impossible if the product is a service. For example, a buyer cannot purchase an extra viewing of a movie and resell it. It may be possible to resell the ticket, but inexpensive enforcement methods can limit that type of arbitrage. If the product is a good, then resale is more of a problem. Resale is often used to arbitrage against geographic (third degree) price discrimination. Resale can arbitrage against second degree price discrimination based on quantity or contract restrictions. A high-volume buyer can arbitrage quantity discounts by purchasing extra units at a discounted price and reselling to low volume buyers. A buyer can arbitrage contractual restrictions by purchasing a low price product and flouting the resale restriction.

⁶ See, e.g., *Illinois Tool Works Inc. v. Independent Ink, Inc.*, 547 U.S. 28 (2006); *U.S. Steel Corp. v. Fortner Enterprises, Inc.*, 429 U.S. 610 (1977); *Jefferson Parish Hosp. Dist. No. 2 v. Hyde*, 466 U.S. 2, 14 (1984).

Tying, bundling, and merchandising might be used to implement price discrimination, but could serve other goals as well, which could either have pro-competitive or anti-competitive effects. Tied sales may be used to measure (often the term “meter” is used instead of measure) the intensity of use of the tying product by observing the volume of purchases of the tied product (Elhauge and Nalebuff, 2017). The mark-up on the tied product results in discrimination against high intensity users of the tying product. Similarly, merchandising can be used to meter intensity of support for a sports team, music group, or movie. Mark-ups on merchandise can implement price discrimination against loyal fans. Pricing bundles is relatively complicated. Bundle pricing helps sellers extract greater consumer surplus when consumers disagree over which product in a bundle is more valuable. Sellers can keep customers in the market for products they do not value as much, and at the same time price more aggressively on products they do value highly.

III. WHEN IS PRICE DISCRIMINATION PROFITABLE?

Casual intuition might suggest that price discrimination is always profitable because discriminatory prices allow a seller to capture a greater share of a consumer surplus than uniform prices. This intuition ignores two factors that could make price discrimination unprofitable. First, when there are multiple sellers in a market it is possible for price discrimination to intensify competition between sellers and drive down profits. Second, it is costly to segment customers and block arbitrage, and these costs may exceed the benefits of price discrimination (Leeson and Sobel, 2008).⁷

The profitability of price discrimination changes over time as technologies evolve. The impact of new technologies can either strengthen or weaken a seller’s opportunity to engage in price discrimination. For instance, virtual private network (VPN) services hide the location of internet users, making it more difficult for sellers to engage in geographic price discrimination. For the most part, however, since the 1990’s, digital technologies have advanced the opportunities for sellers to engage in price discrimination. For instance, by measuring the frequency and duration of the use of a work by consumers, metering and on-line licensing technologies enable publishers to obtain much more precise measures of the demand for their products (Goldstein, 1998, p. 200). The availability of this information opens the door to highly refined price discrimination (Netanel, 1996, p. 295; Bell, 1998; Meurer, 1997, p. 880; Manta and Olsen, 2015). Furthermore, technological measures such as digital rights management (DRM) may limit the alteration, copying, or transfer of digital products (Hughes, 2016). These technologies restrict the opportunity for buyers to circumvent price discrimination practices. Similarly, the development of sterile seeds can prevent seeds from sprouting in consecutive years (Jasanoff, 2013), limiting reproduction and arbitrage opportunities in market for genetically modified seeds. Mortimer (2008) finds that bar code scanners and the internet increased price discrimination in the video rental industry. Also, the increased collection of personal data and the emergence of big data may facilitate improved customer sorting and increase the potential profits from discrimination — unless privacy regulation blocks this approach to price discrimination.

The profitability of price discrimination also changes as the strength of intellectual property law waxes and wanes. At its zenith, patent law gives an inventor a monopoly in

⁷ Additionally, experimental work suggests that a fairness constraint limits the potential scope of third degree price discrimination (Englmaier, Gratz, and Reisinger, 2012). More research is needed to examine the robustness of this finding, however. Also there is an open question whether fairness is less salient, and therefore less constraining when discrimination is hidden, for example in the case of metering via tied sales.

a market – best illustrated by patented blockbuster drugs. During the term of the patent, the inventor can exclude competing drug makers who could disrupt price discrimination by catering to discriminated-against customers. It is important to recognize that most patents, and other forms of intellectual property do not lead to monopoly and might not even create much market power. But monopoly is certainly not a precondition to profitable price discrimination. Demsetz (1970) explores the use of price discrimination in competitive markets.⁸ Thisse and Vives (1988), Corts (1998), Holmes (1989), Armstrong and Vickers (2001) and others model various forms price discrimination in oligopoly settings.

Rather than market power, intellectual property law more often influences the profitability of price discrimination by helping or hindering sellers block arbitrage and sort customers. Intellectual property law may allow sellers to control supply chains in ways that minimize arbitrage, and directly control uses and resale by end users. We provide many examples in the sections that follow.⁹

IV. SOCIAL WELFARE ISSUES

Economists usually examine the social welfare effects of price discrimination by comparing it to uniform pricing. The main focus is on: static effects on output and misallocation of goods across consumers; dynamic effects on product design, entry, and innovative investment; and distributional effects.

Third degree price discrimination may increase efficiency by increasing output, especially when price discrimination results in new buyers entering a market who would be foreclosed from the market by a high uniform price (Varian, 1985). In these circumstances, discrimination can leave output in the “stronger” market unchanged while expanding output in the “weaker” market that would otherwise not be served (Robinson, 1933).¹⁰ However, output expansion is only a necessary but not a sufficient condition for welfare improvement; output must expand more in the weak market than it contracts in the strong one because each unit is more highly valued in the latter (Schmalensee, 1981).

To elaborate, price discrimination causes the marginal rates of substitution to differ across buyers, and disfavored buyers have a higher marginal valuation than favored buyers. Disfavored buyers would get a greater marginal benefit from one more unit than favored buyers would lose from giving up one unit. This presents an opportunity to increase total surplus via trade, but this opportunity is lost because arbitrage is blocked. This foregone opportunity represents a source of allocative loss. Overall then, any efficiency gains from an increase in output may be offset by efficiency losses caused by differences in the marginal rates of substitution between favored and disfavored buyers (Viscusi, Harrington, and Vernon, pp. 279-283; Tirole, pp. 137-139).

The static welfare effects of second degree price discrimination are likewise unclear, but perfect price discrimination provides unambiguous gains in allocative efficiency. All consumers can be served to the point that marginal utility equals marginal cost, and thus,

⁸ Levine (2000) analyzes use of price discrimination to recover sunk costs in a competitive environment, and Hovenkamp (1999) discusses the limited market power required to engage in price discrimination.

⁹ Market power itself may also increase a seller's ability to limit arbitrage. One avenue to limit arbitrage is self-help, whereby a seller punishes users and distributors engaged in arbitrage. Because measures to deter arbitrage are unpopular among distributors and customers, a seller with market power, especially a monopolist, is more likely to be willing and able to incur this cost.

¹⁰ Additionally, discounts and other forms of two-part pricing can increase social welfare (Tirole, 1988, pp. 145-46).

marginal rates of substitution are equalized and no consumers are rationed. Uniform monopoly pricing might still have a social welfare advantage over perfect price discrimination, but that depends on the dynamic and distributional effects that we turn to now.

The additional profits that may be created by price discrimination may induce socially valuable investment or socially harmful rent dissipation. Many commentators have noted that price discrimination may augment the reward to authors and inventors and induce a valuable boost in creative or innovative investment (for example, Demsetz, 1970). Though of course it is possible for this reward to be too large and induce overinvestment. Furthermore, by increasing rents, price discrimination may induce socially wasteful rent-seeking investments. Firms may engage in socially wasteful lobbying, litigation, and entry deterring practices that work to preserve their right and ability to engage in price discrimination (Posner, 1986; Meurer, 1997).

Patents or copyrights may create entry barriers and allow firms to earn positive economic profits, but this is not always the case.¹¹ When entry barriers are absent, increased rents from price discrimination will drive entry into the market until profits fall to zero. This entry may be socially valuable because of added product variety, or socially harmful if entrants make duplicative investments to enter the market without providing significant social benefits in the form of greater variety or quality improvement (Katz, 1984).

Finally, price discrimination may give rise to various social costs from measuring consumer attributes and blocking arbitrage. Direct social losses arise from the cost of identifying customer attributes and choices, writing and enforcing contracts that prevent arbitrage, and designing special distribution systems.¹² Indirect costs arise from the sorting constraints associated with second degree price discrimination¹³ by which a seller may sort buyers by offering a menu of delivery dates, qualities, quantities, and permissible uses of the product (Meurer, 1997; Meurer, 2001). If delivery is the choice variable, then the sorting cost arises from the delivery delay. For many products the optimal delivery policy is immediate availability. If quality is the choice variable, then the sorting cost arises from degraded quality for lower valuation buyers¹⁴ (for instance, software with code that disables certain features; see Deneckere and McAfee, 1996). If quantity is the choice variable, then the sorting cost comes from rationing of low valuation buyers (Maskin and Riley, 1984). The seller designs quantity discounts in such a way that low valuation buyers purchase less than they would under third degree price discrimination. The rationing is introduced to ease the sorting constraint and to enable the seller to charge a higher price to the high valuation segment of consumers. If use restriction is the choice variable, then the sorting cost is the restriction itself. Consumer surplus is lost to low valuation buyers who are constrained in their use of a product. The sorting constraint imposes an implicit cost on the seller because it restricts the freedom of

¹¹ Intellectual property laws raise the cost of creation and innovation when a new work depends on older works in such a way that permission is required to create or exploit the new work (Landes and Posner, p. 332; Lemley, 1997; Scotchmer, 1991; Gordon, 1992).

¹² Implementation costs are most problematic when there are entry barriers and few sellers. Implementation costs are apt to decline as the number of discriminating firms in a market grows (Stole, 1995).

¹³ By contrast, under third degree price discrimination, a monopolist seller treats each market niche separately and no product design or sale distortions are caused. The seller extracts rents solely on the basis of pricing differences.

¹⁴ Economic theory shows that a seller should set the optimal attribute for the high valuation consumers and a suboptimal attribute for the low valuation consumers. This inefficiency creates a hidden social cost of sorting.

the seller to select the optimal attributes. With third degree price discrimination the seller can avoid sorting costs and select the optimal attributes for the two classes of consumers independently.

Besides efficiency, social welfare depends on the distributional effects of price discrimination. Generally, the impact of price discrimination is felt differently across various potential buyers. Buyers with higher valuations (or more precisely lower elasticity) tend to lose and buyers with lower valuations (higher elasticity) tend to gain. High elasticity customers, often the poorer segments of the consumer base, are especially likely to benefit from third degree price discrimination (Tirole, 1988, pp. 137-39).

Two special cases are often discussed in the literature. First, perfect price discrimination transfers all consumer surplus to a monopoly seller. Thus, efficiency is in tension with a pro-consumer distributional goal, and social welfare may be higher under a uniform monopoly price if the social welfare function places sufficient weight on consumer surplus as compared to profit. Second, there are instances of imperfect price discrimination that are Pareto-improvements over a uniform monopoly price.¹⁵ For example, if a uniform monopoly price excludes a low valuation segment from a market, and optimal third degree price discrimination keeps the original monopoly price in place for the high value segment of the market and offers a lower price that induces purchases by the low value segment, then high valuation consumers are indifferent between the two schemes, low valuation consumers are better off with price discrimination, the seller is better off with price discrimination, and allocative efficiency is improved.

The social welfare comparison between perfect price discrimination and uniform monopoly pricing generates interesting insights but other comparisons are also useful. An intellectual property scholar may be interested in a welfare comparison between two different forms of price discrimination that are practiced before and after a substantive change in intellectual property law. In the following sections we consider several examples of how a change in the law may lead a seller to switch the form of price discrimination it practices because arbitrage or metering has become harder or easier.

V: A SOCIAL WELFARE ANALYSIS OF PRICE DISCRIMINATION IN THE IP CONTEXT

As discussed in detail in the following section, copyright and patent law contain a wide range of doctrines that facilitate or impede price discrimination.¹⁶ In this section we review the law and economics literature that abstracts from doctrinal details and considers broad normative questions about the interaction between price discrimination and copyright or patent protection.

A. Copyright

One strand of literature takes a generally positive view toward price discrimination. These authors focus on the power of digital technologies to better measure preferences and limit arbitrage and thereby make price discrimination more attractive to sellers of

¹⁵ Conditions such that all prices fall under discrimination or rise only for the relatively well off are discussed in Stole (2003) and Schwartz (1990).

¹⁶ The first studies to recognize the link between copyright doctrine and price discrimination include Fisher (1998), Besen and Kirby (1989), Besen, Kirby and Salop, (1992) and Lunney (1996). For a comprehensive analysis of the relationship between copyright law and price discrimination, see Meurer (2001).

copyrighted works.¹⁷ The price discrimination optimists emphasized two social benefits that might flow from finer grained price discrimination in digital markets. First, increased product variety and a more detailed menu of prices could improve access of poor or other underserved consumers (Fisher, 1998).¹⁸ Second, assuming the price discrimination enabled by digital technology would increase profit,¹⁹ this would bolster the incentives to create (Hardy, 1996; Besen and Raskind, 1991, p. 5). Fisher noted that “we are getting much more bang for our buck—a much larger incentive for creative activity per unit of social cost. Such a system of rules, applied to the Internet, should move us faster than a copyright-based system in the direction of an informational society and rich artistic tradition.” (Fisher, 1998, p. 1240).²⁰

Besides making price discrimination more profitable, certain new technologies reduced transaction costs and diminished one of the justifications for the fair use defense and certain statutory limits on the rights of copyright owners. New technologies also made it easier to limit resale of copyrighted content, and copyright owners bolstered technical barriers to resale with contractual limits.²¹ Several scholars applauded these developments and argued that copyright law should accommodate efforts by sellers to block arbitrage in digital markets (Bell, 1998; Friedman, 1998; Fisher, 1998; Merges, 1997; O'Rourke, 1997; Kitch, 1999), including scaling back the scope of fair use (Bell 1998, Kitch, 1999).²²

Critics contend the alleged benefits of price discrimination arise in market conditions very different from those that apply to creative and informational works (Gordon, 1998, p. 1389; Boyle, 2000) or apply only to specific markets (Lunney, 2008). A monopolist with the capacity to price discriminate might be preferable to a monopolist that charges a single, uniform price. But perhaps the correct comparison would be with a system that permits lawful free copying and a resulting range of prices. In other words, highlighting the benefits of a monopoly with price discrimination compared monopoly without price discrimination is misleading (Gordon, 1998, pp. 1383-84).

This second strand of literature takes a generally skeptical view of the social benefits of price discrimination.²³ Digital technology, especially the growth of the internet, enabled massive amounts of unauthorized copying and dissemination of copyrighted content. Courts and legislatures responded by expanding the scope of copyright to combat piracy. Critics complained that anti-piracy reforms also promoted socially harmful price discrimination.

¹⁷ The pioneering writing by Goldstein envisioned a “celestial jukebox” from which consumers could listen to any song in exchange for a micropayment (1994).

¹⁸ On the increase of output and new buyers entering a market that would otherwise be foreclosed by a high uniform price, see generally, Viscusi, Harrington and Vernon, 1992, pp. 282-83. In the context of software sales, see *ProCD, Inc. v. Zeidenberg*, 86 F.3d 1447, 1449 (7th Cir. 1996); Manta and Olson (2015). On the positive impact of price discrimination on developing countries that publishers might otherwise ignore, see Netanel (1998, p. 224).

¹⁹ Empirical evidence can be found in Leslie (2004) and Mortimer (2008a, 2008b).

²⁰ Fisher also suggests a series of reforms designed to preserve the public benefits of specified types of access and/or use (Fisher, 1998). See also Merges (1997).

²¹ For a critique of these tactics, see Perzanowski and Schultz (2001) (misalignment with goals of copyright law); Perzanowski and Hoofnagle (2016) (consumer protection).

²² Others point out, however, that such technologies do not eliminate bilateral monopoly (Merges, 1997) or anticommons issues (Depoorter and Parisi, 2002).

²³ For a discussion of the diverging views on price discrimination among copyright optimists and pessimists, see Netanel (1996).

Cohen (1998, 2000) emphasizes copyright law's limitations and exemptions generate public benefits that likely would be underproduced by a system of centralized, strictly market-based control. She argues that copyright law is balanced to serve nonmonetizable and distributional concerns that are central to the creative and social progress (Cohen, 1998, p. 1128; Merges, 1997).

Full-fledged price discrimination might upset the existing balance of rights and the ecosystem of tolerated uses that have been identified in various writings (Boyle, 2000; Tehranian, 2007; Wu, 2008; Balganesh, 2013). In doing so, cumulative creation might slow down if a legally sanctioned price discrimination regime, bolstered by technology and contract rights, reduces access to information that was previously available due to the limited enforceability of contracts of adhesion, first sale, fair use, etc. (Boyle, 2000, p. 2032; Cohen 1998, p. 1809).

Another social welfare loss of enhanced price discrimination that should be considered is the elimination of free access to previously non-excludable aspects of information works. This might reduce the variety and diversity of works produced (Cohen, 1998; Benkler, 1999). Overall, the loss of free access “may or may not outweigh the welfare gained from access to newly excludable aspects of the work at a lower price than previously available” (Benkler, 2000, p. 2076). Free access might be particularly relevant for (1) works with uses for which it is hard to predict the value *ex-ante*; (2) high positive externality productive uses; and (3) public domain works produced for free distribution (Benkler, 2000).

Moreover, increasing the reward to copyright holders by promoting price discrimination may distort the pattern of investments in creative products. For instance, if price discrimination is easier for copyrighted works than for other products it may lead to overinvestment in copyrighted works (Lunney, 1996, p. 633; 2008) or the types of works that enable price discrimination or allow a producer to cover the fixed costs of price discrimination (Baker, 1997, p. 344).²⁴ Also, since price discrimination may lead a firm to produce multiple products to implement discrimination through quality differentiation, bundling, and tying, multiproduct firms will do better when legal obstacles to price discrimination are removed (Baker, 1997, p. 346).

On a more granular level, Meurer (2001) distinguishes situations where price discrimination may be socially desirable (and copyright law should promote it), from instances where price discrimination is undesirable (and copyright law should discourage it).²⁵ Sound policy must consider whether price discrimination can be controlled. Whenever IP law enables arbitrage, there is a risk that doing so displaces benign price discrimination into other more pernicious forms. For instance, if a seller cannot rely on copyright law to block arbitrage it might rely instead on DRM technologies, product design, marketing methods, and vertical integration. Similarly, a seller may degrade product quality to sort customers (Deneckere and McAfee, 1996), or a seller may over-rely on leasing or conversion of durable goods into services to block arbitrage. Also, a firm that sells intermediate goods might inefficiently integrate downstream displacing low value consumers so that it can set a high price to high value consumers with no concern about arbitrage.

Finally, price discrimination may engender additional social costs, such as loss of privacy, personal autonomy, and foregone ethical or distributional commitments (Boyle,

²⁴ On product diversity more generally See Dixit and Stiglitz (1977).

²⁵ Katz (2014) argues that post-sale restraints are beneficial when coproducing or collaborating firms are imperfectly vertically integrated.

2000, p. 2027) unless effective regulation of personal data retention and analysis is put in place (Bar-Gill, 2018).

B. Patents

In the context of innovation and patents, discussion of price discrimination is also polarized across optimists and pessimists.

Optimists point to increased profitability for the patentee (Sidak, 1981) and the increased incentive to innovate (Bowman (1973, pp. 56, 112; Klein and Wiley, 2003), or to increase product variety (Wright, 2005). Grennan (2013) documents increased competition resulting from price variations.

Hausman and MacKie-Mason (1998) point to the potential for price discriminators to serve new markets and achieve scale and learning economies. They also make the important point that, if the optimal policy solution is to apply the least costly manner of rewarding innovators, if patentees are allowed to benefit from price discrimination, this would enable other socially desirable adjustments, such as the reduction of the patent term (Hausman and MacKie-Mason, 1998, pp. 263-64). Kaplow makes a similar argument (1985, p. 524).

Pessimists highlight output restrictions (Sullivan, 1977) and other inefficiencies caused by charging different prices (Baxter, 1966; Kaplow, 1984). Others point to how the rents from price discrimination may induce socially wasteful rent-seeking (Posner, 1975) and lead to excessive investments (Sykes, 2002) as well as socially wasteful patent races that may include potentially duplicative R&D costs (Rai, 2001, p. 199; Sykes, 2002; Scotchmer, 2004, p. 98; Abramowicz, 2003, p. 129). Rent-seeking is aggravated by the enhanced risk of frivolous or anti-competitive litigation created by patent and also copyright rights. The difference between a simple contract claim, on the one hand, and a patent or copyright infringement claim, on the other hand, is that the latter provides the IP owner significant strategic advantages because of the threat of preliminary and permanent injunction, fee-shifting, and treble damages for willful infringement. Furthermore, IP rights can be asserted against innocent strangers (perhaps importers) who might be vulnerable to an opportunistic IP suit. These rent-seeking costs need to be balanced against any incentive benefit before IP rights are expanded to support price discrimination (Meurer, 2003, pp. 1881-82).

As reflected in our previous discussion of the social welfare effects of price discrimination in copyright dependent markets, normative conclusions in the patent context depend on assumptions regarding the appropriate scope and social desirability of the patent reward for optimal innovation. Since there is a variety of opinions on the dynamic welfare effects of patent rewards, there are likewise a variety of opinions about the desirability of price discrimination practices that increase the reward for patentees.

VI. THE MANY FORMS OF PRICE DISCRIMINATION BY WAY OF IP RIGHTS

A. Geographic Price Discrimination

Sellers commonly establish exclusive territories in order to facilitate third degree geographic price discrimination but also to encourage investment by distributors in local goodwill and service. In response, gray markets emerge to arbitrage away price differentials that are caused by exclusive national territories. Empirical evidence establishes that geographic price discrimination is common, and probably the most

important cause of gray market transactions (Gallini and Hollis, 1999, p. 6; Malueg and Schwartz, 1994, pp. 173-74).

Because transportation costs are relatively low for most copyrighted works and many patented inventions, sellers may need to rely on the force of law to prevent arbitrage. Legislative bans on parallel importation as well as contractual restrictions are some common instruments that reduce arbitrage and help implement price discrimination. These trade restrictions run counter to some intellectual property doctrines, however.

In copyright law, the “first sale” doctrine (section 109(a) of the Copyright Act of 1976) provides the owner of a lawfully made copy of a work the right to sell it without the copyright holder's authorization. This doctrine seems at odds with Section 602(a) which prohibits the unauthorized importation of a copyrighted work.

In *Quality King Distributors, Inc. v. L'anza Research Int'l, Inc.*, 523 U.S. 135, 118 S. Ct. 1125; 140 L. Ed. 2d 254 (1998) the United States adopted a partial exclusion of international price discrimination, permitting exclusion of gray market goods that are manufactured abroad. The application of the exhaustion principle only to goods produced domestically provided a perverse incentive to shift domestic production abroad (Goldberg, 2012). In *Kirtsaeng v. Wiley*, 568 U.S. 519, 133 S. Ct. 1351 (2013) the U.S. Supreme Court did away with this distinction based on the location of manufacture and held that the first sale doctrine applied to all legally produced goods, regardless of origin of manufacture. This precedent effectively eliminated the opportunity for sellers to use copyright law to block gray market goods in support of geographic price discrimination.

Kirtsaeng probably had a particularly significant impact on the music and movie industries. It is hard to use product differentiation to support price discrimination for these products. Additionally, customer service and warranties are not relevant to serve as a basis of price discrimination. One possibility at the disposal of producers is to dub movies and shows into foreign languages. Another possibility is to encode movies or music, so they can only be played on devices manufactured for a particular country or region. The movie industry has taken steps in that direction with country codes embedded in DVD movies. Such measures are costly of course both with regard to the costs of implementation and the loss of consumer satisfaction (Meurer, 2001).

Similarly, in the area of patents, sellers of patented products commonly charge higher prices in the United States than abroad. To maintain these price differences, such sellers prohibit the resale of their goods in the United States. The U.S. Patent Act defines infringement in 35 U.S.C. § 271(a) by imposing liability on “whoever without authority makes, uses, offers to sell, or sells any patented invention, within the United States or imports into the United States any patented invention during the term of the patent....”

The doctrine of patent exhaustion, however, offers a defense to importers, users, and sellers of a patented invention if the patent holder has either authorized a first sale of a patented item or licensed its use or sale. Accordingly, whenever a patentee sells an item, it “is no longer within the limits of the [patent] monopoly” and instead becomes the “private, individual property” of the purchaser. *Bloomer v. McQuewan*, 14 How. 539, 549-550, 14 L. Ed. 532.

The hostility toward restraints on alienation is highlighted in *Impression Products v. Lexmark*, 137 S. Ct. 1523 (2017). The Supreme Court held that a purchaser has the right to use, sell, or import an item because those are the rights that come along with ownership, regardless of a patentee desire to expressly limit the purchaser's rights in this regard. In the dispute, Impression Products imported patented printer cartridges that

Lexmark sold abroad. Impression Products refurbished the cartridges and undercut the price that Lexmark was charging for the cartridges in the U.S. This arbitrage was permitted under the exhaustion doctrine. Interestingly, Lexmark may have been using cartridge sales to measure the frequency of use of Lexmark printers, in pursuit of a form of second degree price discrimination that we will discuss more in Section VI.C.

For commentators who embrace a global social welfare perspective, geographic price discrimination may have desirable distributional effects, for example, facilitating lower pharmaceutical prices in poor countries. Though, sellers might lower prices of patented goods in the United States and raise prices abroad (Hemel and Larrimore Ouellette, 2016). The benefit from low prices in poor countries might be eroded if sellers design lower quality products to market in countries with weaker demand (Meurer, 2001, n. 397).

Finally, in the area of trademarks, goods bearing identical trademarks are regularly sold at different prices in different geographical regions. Trademark owners seek to protect against arbitrage by arguing that use of the trademark on the imported (grey market) goods is unauthorized and infringes the exclusive right to use of a trademark on a particular product in a specific geographic area (Lansing and Gabriella, 1993).²⁶

Supporters of geographic price discrimination by trademark holders argue that gray marketeers unfairly free-ride on the advertising and goodwill developed by trademark owners and authorized distributors (Liebeler, 1987, pp. 756-57). Gray markets may also be harmful to consumers because goods are not sold with the same warranties and quality assurances as products sold through authorized channels (Higgins and Rubin, 1986, pp. 228-29; Landes and Posner, 1987, pp. 308-09; Liebeler, 1987, p. 755; Lipner, 1990). They claim that territorial divisions enable producers to provide consumers with improved services and assurances of quality. Excess profits resulting from territorial division and restricted competition can be used to improve the quality of goods purchased by consumers. (Philips, 1981; Tirole, 1988). Moreover, price differentials might be driven by differences in tastes, technologies, and government regulations across regions (Peterman, 1993; Lansing and Gabriella, 1993).

Critics of geographic price discrimination point to consumer benefits resulting from lower prices (Rubin, 1992, pp. 618-22), free trade (Lipner, 1990), and intrabrand competition (Gallini and Hollis, 1999) enabled by grey markets. To the extent that geographic price differentials reflect monopoly power, grey markets help erode barriers to trade (Dam, 1964, pp. 53-60). Ghosh (1994) provides a formal model to suggest that the most efficient result is to permit gray market goods that have alternative labels. Additionally, prohibiting grey markets imposes considerable public enforcement costs (Ghosh, 1994, pp. 378-79).

B. *Restrictions on Type of Use*

Software sellers often charge different prices for commercial versus personal or academic use. Contract law can be used to enforce the restriction limiting low-priced software purchasers to non-commercial use (*ProCD, Inc. v. Zeidenberg*, 86 F.3d 1447, 1449 (7th Cir. 1996)). But these sorts of restrictions are more robust when intellectual property law can be used to enforce the restrictions. Intellectual property remedies are

²⁶ A U.S. trademark holder may bar the importation of goods bearing the same trademark when manufactured by a foreign manufacturer but cannot stop importation of goods made under the control of the domestic trademark holder. See *K-Mart Corp. v. Cartier, Inc.*, 486 U.S. 281, 292 (1987).

often stronger than contract remedies, and intellectual property claims are available against arbitrageurs who are strangers to the seller, thereby overcoming the privity limitation on contract claims.

Patent law broadly facilitates restrictions on type of use. A patent owner has the right to exclude others from *use* of a patented invention. The predominant view in patent law states that because the patent owner can exclude all use, the statute gives an implied right to grant permission for some uses and still sue the licensee for infringement if she engages in an unauthorized use.²⁷ For example, DuPont imposed a field of use restriction and charged different prices for a patented synthetic fiber depending on the end use intended by the customers (*Akzo v. Int'l Trade Comm.*, 808 F.2d 1471 (Fed. Cir. 1986)).

Copyright gives somewhat limited support for restrictions on the type of use.²⁸ Much of the value from movie and music copyrights comes from the public performance right which allows copyright owners to control public performances of their works (17 U.S.C. §106(4)). This right facilitates price discrimination in the movie and music markets between home users and buyers who want to engage in a public performance, e.g., exhibiting a movie in a theater or broadcasting music on the radio (Besen and Kirby, 1989; 1992). It also facilitates the fine-grained price discrimination practiced by ASCAP, BMI, and SESAC (collective rights organizations that administer blanket public performance licenses on behalf of music composition copyright owners). The royalties associated with the blanket licenses vary according to the size and revenue of the establishment using the license.

The potent threat created by a possible copyright suit helps assure compliance with the price discrimination schemes used for the public performance of music and movies. In this manner, copyright law channels sellers into choosing a relatively socially beneficial form of price discrimination rather than a more socially harmful form. If the public performance right were deleted from the statute, music and movie producers would need to find another, likely costlier, way to discriminate between buyers intending to publicly perform the work, and buyers intending only private use. One possibility would be a very high initial sales price followed, after a significant delay, with a lower sales price targeted at home users. Another possibility would be vertical integration into movie exhibition or radio broadcast. The public performance right allows discrimination and avoids the high implementation costs associated with the other strategies (Meurer. 2003, pp. 1883-84).

Finally, we note that the performance right is limited by certain exemptions that have the effect of limiting the scope of price discrimination. For instance, 17 U.S.C. §110 exempts educational and nonprofit performances from the reach of the public performance right. These exemptions might be justified by relatively high transaction costs compared to the private value of these sorts of public performances to purchasers. In effect, through these exemptions copyright brings about price discrimination for users intending a public performance, while sheltering certain users who might generate positive externalities (Meurer. 2003, p. 1883).

C. Intensity of Use: Tying, Merchandising, and Bundling

Price discriminating sellers often link prices to a direct or indirect measure of the intensity of use of a durable product. Ideally for the seller, buyers would truthfully

²⁷ Bowman, (1973, pp. 140-42). But see Kaplow (1984, p. 1846). The implied right is made explicit regarding restrictions on location of use. *See* 35 U.S.C. §261.

²⁸ Lunney (1996) analyzes how the right to create derivative works enables price discrimination.

respond to queries about how frequently they will use a product and how many people will benefit from the use. Most often the high intensity users would be willing to pay more for the product, and prices would be set accordingly.

Typically, price discrimination relies on indirect measures of intensity of use because direct measures are hard to implement. Usually it is costly to monitor use, easy to evade restrictions, and usage based measures and monitoring sometimes annoy consumers. Nevertheless, sellers of software often set prices for enterprise or site licenses based on the number of users or machines that are licensed. Arbitrage may be discouraged by contract terms that allow the software vendors to audit customers' facilities.

In some cases, technology intrinsic to the product or added to the product can be used to facilitate monitoring. The odometer on a rented car or a usage meter on office equipment can be used to set rental prices based on intensity of usage. Today, sellers can monitor usage of any equipment connect to the internet, for example, mobile phone data plans.

Additionally, patent and copyright law can be used to bolster contract-based approaches to usage based pricing. As we discussed in the previous section, IP infringement claims against strangers, and strong IP remedies strengthen the enforcement power of sellers against arbitrage. Infringement claims are well grounded in patent law because the patent owner has broad control over use. To illustrate, in *Brulotte v. Thys Co.*, 379 U.S. 29 (1964), the patent owner sold patented farm equipment and included a license term that required royalty payments based on the bushels of harvested crop.

Copyright law does not offer a comparably broad use right but in some important settings unauthorized use is infringing. Computers (and other consumer electronic devices) usually make a temporary copy of digital content or software during use. Even though temporary, such a copy may be infringing. Thus, a digital copyright owner can sue a buyer who violates a frequency of use restriction for breach of contract, and also for copyright infringement because of the unauthorized temporary reproductions. Copyright law imposes two important limits on these infringement claims. Section 117 gives software owners the right to make copies as an essential step in using a program, and the copyright misuse doctrine may restrict sellers from using this strategy in certain settings.

Sellers use a variety of tactics to indirectly measure intensity of use by measuring consumption of some complementary product that is used with the durable product. For example, a patent owner leased a patented canning machine and required lessors to purchase the salt that they needed for canning from the patent owner (*International Salt Co. v. United States*, 332 U.S. 392 (1947)). Tying rental of the machine to sales of salt offered the patent owner a method to measure intensity of use – assuming those who used the machine more needed to use more salt. Besides tying agreements, a seller might design its durable products in such a way that it has an advantage selling a complementary product because of a proprietary interface between the durable product and the complementary product. Additionally, a seller might use the threat of an IP lawsuit against the maker or seller of the complementary product to achieve exclusivity in the market for the complementary sales. Some sellers use all three of these tactics to control sales of the complementary product.

In a tying arrangement, the seller charges a supra-competitive price for the tied product and then measures the intensity of use of the tying product on the basis of the sales of the tied product. Because the price for the tied product is usually marked up beyond the competitive price, high-volume users are effectively charged a higher price

for the tying product (Klein and Wiley, 2003, pp. 604-05; Butler, Lane, and Phillips, 1984, p. 190; Hansen and Roberts, 1980). This creates a social loss as *all buyers* purchase too little of the tied good. This loss might be offset by a reduction in the price of the tying product that induces new buyers to enter the market (Lichtman, 2000).

Classic cases include *IBM Corp. v. United States*, 298 U.S. 131 (1936) where IBM leased patented tabulator machines on the condition that the lessee purchase all of the punch cards needed for use in the machines from IBM. Punch card purchases measured frequency of use. Rather than charging a rental rate that varied directly with frequency of use, IBM charged a premium over the competitive price for punch cards, and thereby indirectly collected a rental rate that increased with the frequency of use. In *Motion Pictures Patents Co. v. Universal Film Mfg.*, 243 U.S. 502 (1917) movie projectors were tied to film, and the patent owner derived most of its profit from the sale of film. In *Morton Salt Co. v. G.S. Suppiger Co.*, 314 U.S. 488, 489-90 (1942) the lease of a patented canning machine was tied to the sale of salt tablets and salt sales metered the intensity of use of the canning machine.

Rather than a tying agreement, a seller may use the design of a product interface to gain control over the sale of a complementary product. In *Sega v. Accolade*, 977 F.2d 1510 (9th Cir. 1992), Sega sold video game consoles that were used in conjunction with game cartridges. Sega controlled the cartridge market via software required to make the cartridges function in the console. By earning a licensing fee on authorized cartridges, Sega could indirectly distinguish between purchasers of the console who bought only a few cartridges and those who bought many, and it could use this system to implement usage based price discrimination. Ultimately this strategy failed because Accolade was able to reverse engineer the interface and make and sell compatible cartridges that were not authorized by Sega. Sega sued Accolade for copyright and trademark infringement and lost on both grounds. In other contexts, a seller may have better luck if the interface is difficult and costly to reverse engineer, or if the interface is protected by a patent. Sellers can block all use of a patented interface, they have had mixed success enforcing contracts that preclude reverse engineering, but reverse engineering is typically permitted under trade secret and copyright law.

A third approach to controlling frequency of use relies on the threat of IP suits against competing suppliers of the complementary product. For example in *MAI Systems v. Peak Computer*, 991 F.2d 511 (9th Cir. 1993) MAI threatened copyright litigation to discourage third parties like Peak from providing maintenance services to buyers of MAI computers. MAI computers relied on an operating system copyrighted by MAI and they contended that when Peak turned on the computer to perform a maintenance service, a copy of at least a part of the operating system software was necessarily made in the computer's random access memory (RAM). The court found that copying infringed on the reproduction right.²⁹ Until Congress adopted legislation to reverse this outcome,³⁰ the plaintiff was able to use the ruling to exclude the defendant from the maintenance market. Similarly, in certain cases, patent law may facilitate control over a complementary product by allowing contributory infringement suits against competing suppliers of the complementary product (Meurer, 2003).

²⁹ Specifically, the court held that a computer's RAM satisfies the fixation requirement and a temporary RAM copy is a reproduction within the meaning of Section 106(1).

³⁰ Congress reversed this result in the Digital Millennium Copyright Act. See 17 U.S.C.A. §§ 117(a),(c)-(d) (West 1999) (these sections reflect the amendments to 17 U.S.C.A. by §301 of the Digital Millennium Copyright Act).

In other contexts, the threat of copyright and trademark lawsuits can be used against makers and sellers of merchandise that is consumed as a complement to a copyrighted work. Movies and television series producers have succeeded in “merchandising” products derived from their audiovisual works. Merchandising implements usage based price discrimination if the highest valuation consumers are the ones who buy the most merchandise. Trademark law may protect the title and characters from movie or television series, and copyright law protects the use of images from these audiovisual works. The threat of IP suits gives the movie and television producers the chance to control the markets for posters, clothing, toys, games, and other merchandise based on the copyrighted work.

In general, the social welfare effects of usage based pricing can be positive or negative. Output based pricing tends to draw new customers into a market, specifically, customers who are infrequent users who are attracted by the relatively low price charged for infrequent use. At the same time, consumption tends to fall among current customers who formerly consumed as much as they wanted, and now face a positive price for each additional use.

The social welfare effects of tying arrangements, in particular, have been widely debated. Pessimists fear that tie-ins restrict competition in the tied product market. Tying can be used to leverage monopoly power from the primary market (tying product) to a secondary market (tied product) (Carlton and Waldman, 2002, p. 194; Leslie, 2004). Tying arrangements may distort competition by deterring entry into the market for the tied product. In markets with incumbents that sell tied products, competitors may face an uphill battle in order to achieve sufficient scale to compete or even cover fixed costs (Nalebuff, 2004; Whinston, 1990; Elhauge, 2009, pp. 413-14). Optimists are skeptical that monopolists can increase their total market power by way of tying, since price increases in one market are likely to lead to lost profits in the other market (Bork, 1978, pp. 366-67, 372; Posner, 2001, p. 201). Others maintain that tie-in metering protects goodwill, promotes quality control (Meese, 1997), can increase product quality (Dana and Spier, 2015) and may bolster research and development by enabling patent holders to recover more of the social value of their inventions (Wright, 2005; Grill, 2006), and that improved information may increase producer and consumer surplus (Hylton and Salinger, 2001). Metered tying has also been associated with social welfare benefits if it leads to improved sales of durable goods (Elhauge and Nalebuff, 2017).

Similar to the issue of tying, any normative assessment of merchandising and the appropriate scope of copyright and trademark support of merchandising will depend on one’s view on the optimal reward for the copyright owner. Skeptics argue, however, that broad exclusive rights on merchandising distort creative activities, causing excessive investments in story lines and productions with an eye on toys and other merchandise that can be derived from the movie. (Lunney, 1996, pp. 640-41; Sterk, 1996, p. 121; Meurer, 2001, pp. 128-29; Wyatt, 1994, p. 149; Litwak, 1997, p. xii).

An interesting question exists whether a patentee of a tying product has an incentive to stifle or bolster innovation in the tied product market. On the one hand, a tying seller would benefit from innovation in the tied product market since improvements of a complementary product likely increase demand for the patentee’s product. On the other hand, innovation in the tied product market could potentially undermine the patentee’s dominant position and profitability in the tying product market (Feldman 1999, pp. 2091-93; Leslie, 2011, pp. 834-35; Choi, 2003). For that reason, patent tying can reduce the incentives for innovation in the tied product market (Hovenkamp, 2007; Choi and Stefanadis, 2001, 2006). Additionally, by forcing rivals to enter two markets concurrently, tying can stifle competition and innovation in the tied product market

(Eastman Kodak Co. v. Image Tech. Servs., Inc., 504 U.S. 451, 485 (1992) (citing Jefferson Parish Hosp. Dist. No. 2 v. Hyde, 466 U.S. 2, 14 (1984)).

We close this section by discussing a related method of price discrimination known as bundling. We distinguish tying agreements that bundle a complementary product that helps a seller measure the intensity of demand for some durable product, with other bundles that serve to smooth demand by heterogeneous consumers over multiple products. Bundling naturally aligns with the goal of copyright law to promote broad diffusion of creative works.

Bundling promotes diffusion because bundles are easier to price. Averaging consumer demand over multiple products reduces the variance in demand. This means there are fewer buyers in the “tail” of the demand curve who get excluded.

Bundling creates several other possible benefits. The clearest benefit is a reduction in transaction and enforcement costs. The blanket licensing practice of the copyright collectives provides the best illustration. The U.S. Supreme Court suspended the per se rule against price fixing in an antitrust case against BMI due to the difficulty of enforcing the public performance right (*Broadcast Music, Inc. v. Columbia Broadcast. Sys. Inc., 441 U.S. 1 (1979)*). Bundling may also avoid wasteful investment in measuring the value of the components of a bundle (Kenney and Klein, 1983), to lower distribution costs (Hannsen, 2000) and problems associated with anticommons fragmentation (Depoorter and Parisi, 2003).

A bleaker perspective is that bundling may reduce consumer surplus and reduce entry into digital information goods markets by competitors (Bakos and Brynjolfsson, 2000a). Nalebuff (2004) claims that bundling enables a company with market power in two goods to make it harder for a rival with only one of these goods to enter the market.³¹

Bakos and Brynjolfsson (2000b) predicted correctly that digital technologies and distribution would amplify both disaggregation-based pricing strategies, such as iTunes, and aggregation strategies, whereby information goods will be offered in bundles, site licenses, and subscriptions, such as Spotify, Hulu, Netflix etc. (Roin, 2014; Liebowitz and Margolis, 2009).

D. *Sharing*

A highly contentious issue in copyright is the type and extent of sharing by users without permission from copyright owners. Especially in the digital era, private copying and sharing of movies, music, and software has become commonplace. The music industry in particular aggressively pursued the sharing of copyrighted works on file-sharing networks (Depoorter, Van Hiel, and Vanneste, 2011).

Sharing can be defined as any activity such that (1) a single copy of a work provides utility to more than one end-user, and (2) the number of sharing users is relatively small. Copyright markets feature three common types of sharing: joint use through performance; reproduction leading to simultaneous use; and consecutive use through lending or resale. Consumers often buy, sell, and lend used books, movies, and music. Public libraries lend books and other copyrighted works to the public at no charge.

³¹ For a critique of theoretical literature on bundling and, specifically, the lack of empirical grounding, see Kobayashi (2005).

Sharing impacts the feasibility and profitability of price discrimination. It can be used to circumvent price discrimination. Software sharing, for instance, is a common route for arbitrage. It may bring together two different classes of buyers that the seller would like to keep separate for the purpose of price discrimination. Software sellers often discriminate between the academic and business markets, or between the home and business markets. This sort of discrimination is less effective if business users routinely share with academic or home users (Meurer, 2004).

Though sharing may cause losses to sellers, a number of factors help mitigate these losses. With consumers doing some of the work, sharing copyrighted works may provide a cost effective method of production, distribution (Besen and Kirby, p. 255; Novos and Waldman, 1984), and marketing. Additionally, sharing may induce network effects that raise the value to users (Conner and Rumelt, 1991; Takeyama, 1994; Shy and Thisse, 1999).³² These benefits from sharing can be deliberately attained if the copyright owner authorizes sharing and sets prices to capture some of the benefits. Sharing poses a particular threat to profit when sharing decreases distribution costs (Bakos, Brynjolfsson, and Lichtman, 1999) or when authorized purchasers do not appropriate (or otherwise account for) much of the value derived by other users (Meurer, 2011, pp. 133-40)

Formally, copyright law allows users to engage in certain sharing activities without permission from copyright owners. Consider, for example, the type of sharing enabled by the VCR. The Supreme Court permitted private videotaping of televised movies under the fair use doctrine in *Sony Corp. of America v. Universal City Studios, Inc.* (464 U.S. 417 (1984)). Additionally, Congress refused to prohibit unauthorized commercial rental of videotapes.³³ Informally, copyright owners tolerate many private, non-commercial sharing activities (Tehrani, 2007; Wu, 2008).

Restrictions on sharing may be socially harmful if (1) the owner blocks socially valuable sharing because it is unprofitable, or (2) the owner inefficiently distorts the nature of sharing to gain more profit, especially if profits exceed levels necessary to stimulate the creation and distribution of works (Meurer, 1997, pp. 1183-89; 2001, pp. 132-140). Optimally, copyright law should permit sharing when the profit-based incentives of copyright owners are misaligned with the social incentive in maximizing ex post total surplus, provided the social cost in terms of lost productive incentive is not too great (Meurer, 2004, pp. 910-12).

VII. CONCLUSION

The literature we have reviewed has allowed us to compile an intriguing compendium of connections between intellectual property law and price discrimination. We think that new technologies are expanding the range of such connections and present new topics that should be addressed in more depth by intellectual property law scholars. In particular, we expect to see growing commentary on copyright and trademark liability of e-commerce platforms and how that connects to arbitrage and price discrimination. Further, we expect to see growing commentary on the connection between intellectual property, privacy, and antitrust laws and incentives to build and use databases and algorithms in support of price discrimination.

³² Varian (2000) identifies three situations where sharing will prompt a content producer to sell a smaller amount at higher prices and see an increase in profits: 1) when the transactions cost of sharing is less than the marginal cost of production; 2) when content is viewed only a few times and transactions costs of sharing are low; and 3) when a sharing market provides a way to segment high-value and low value users.

To conclude we note a severe imbalance between empirical and theoretical work on intellectual property and price discrimination. The extensive normative analysis we have reviewed is usually inconclusive because commentators lack the evidence to balance the social costs and benefits that theory tells us are created by price discrimination. More troubling, there is relatively little empirical evidence demonstrating that changes in intellectual property cause significant changes in the practice or profitability of price discrimination. Intuition and anecdote point to strong connections but rigorous empirical work needs to be done to confirm our intuitions.

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