JOURNAL OF MEDIA ECONOMICS, *17*(3), 207–217

A Note on Economic Losses Due to Theft, Infringement, and Piracy of Protected Works

Robert G. Picard
Media Management and Transformation Centre
Jönköping International Business School
Jönköping University, Sweden

Enforcement of copyright and related intellectual property rights is designed to halt loss of economic value to the rights holders. This article explores the nature of losses when protected works are stolen, infringed, or pirated and how the losses differ significantly for materials in physical and virtual form. The author shows unauthorized uses create both supply and demand issues and reveals that different forms of illegitimate use produce varying types and levels of economic loss. The author shows how unauthorized uses potentially affect the producers' marginal and average costs, consumer demand, and revenues. The author considers those effects separately for theft, infringement, and piracy of physical and virtual products and shows that negative effects of losses are rarely inevitable and that less harm tends to occur when virtual rather than physical products are involved.

Media have always been subject to theft, copyright infringement, and piracy. However, digitalization of media, widespread availability of information technologies, and availability of media in virtual forms have increased contemporary opportunities for the appropriation of media products without compensation to their creators or producers.

The increased opportunities for appropriation have created great concern, particularly from audio recording and motion picture companies, and led to the development of encryption technologies and proscriptive legislation such as the signal theft provisions of the Communications Act (United States, 1934, 1996) and Digi-

Requests for reprints should be sent to Robert G. Picard, Media Management and Transformation Centre, Jönköping International Business School, Jönköping University, P.O. Box 1026, SE–551 11, Jönköping, Sweden. E-mail: robert.picard@ihh.hj.se

tal Millennium Copyright Act (United States, 1998) in the United States and the InfoSoc Directive of the European Union (Directive 2001/29/EC) designed to punish appropriation or thwart efforts that assist appropriation of virtual products.

Traditionally, media sold to consumers have been content products produced in a physical form, such as newspapers, books, records, and videotapes. A key characteristic in demand for such products is excludability; that is, the product is available only after an economic exchange takes place in the market. Without an exchange, persons are excluded from its use.

It is recognized that not all media are sold in the market and that exclusion is not sought for every media product. Thus, issues of appropriation and its economic affects do not apply to free-to-air broadcasting, for example, because broadcasts are intended to be received without a monetary exchange and the demand effects of exclusion are not an issue. This article focuses on the majority of media products and services for which some transfer of payment is required to obtain them in the marketplace.

Virtual products are analogue and digital content distributed without physical form. Most media today are produced as digital content and can be made available in either physical or virtual form. Books, for example, are typically produced in digital format and then printed in physical form or can be made available as e-books. Audio recordings are digital content that is manufactured and distributed as physical compact discs (CDs) or can be made available in virtual form as electronic files.

There are benefits to producers from digitalization and production and distribution in virtual form; however, they are obtained concurrently with significant reductions in excludability. Efforts to increase excludability of virtual products through technological measures have been only somewhat successful.

Appropriation of media products without compensation has a range of economic effects on creators and producers of content. The nature of these effects differs depending on the type of appropriation and the type of product or service involved. This article presents a typology of those consequences and shows where and how economic harm is created. It is designed to provide a framework by which to analyze effects of uncompensated use of protected products.

APPROPRIATION AFFECTS BOTH SUPPLY AND DEMAND

In determining the economic impact of theft, infringement, or piracy, the effects need to be considered within the context of value chain elements on the supply side and in terms of rivalry among consumers, which affects demand and thus price on the demand side (Figure 1).

On the supply side, the primary difference between physical and digital media is that virtual media products do not require physical manufacturing and production for distributive purposes, thus sparing significant costs to the producing company.

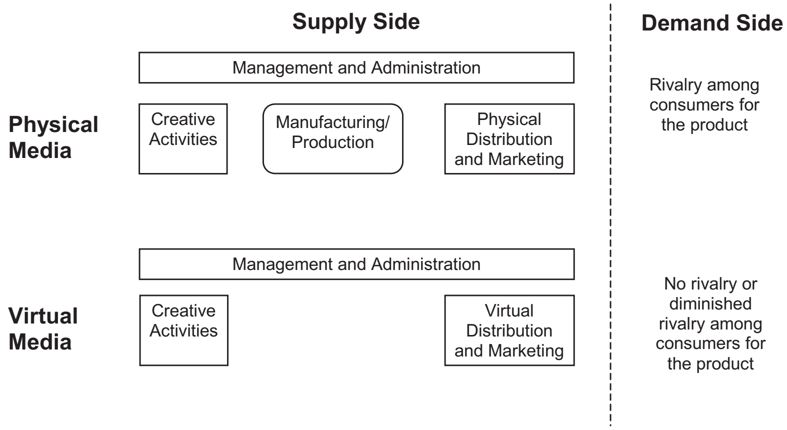

FIGURE 1 Fundamental supply side and demand elements affected by appropriation of a media good.

Costs are also reduced through virtual distribution because of savings in costs for warehousing, transportation, and serving retailers. The actual manufacturing and distribution of physical copies of a CD represents about 30% of the total cost, and retailer costs account for about another 30%. Providing the album in virtual form thus can have significant effects on the producer's costs for supply of the product.

On the demand side, the primary difference is that rivalry to acquire a product disappears or is reduced in virtual media. Rivalry is a crucial factor in price creation, because when the availability of a desired product is low, consumers are willing to pay a higher price and *vice versa* (Brenner, 1990; Bronfenbrenner, Sichel, & Gardiner, 1990; Kuenne, 1998). An important aspect of rivalry is excludability—the ability to exclude those who do not exchange for the product (Gaustad, 2002). If they cannot be excluded, rivalry diminishes or disappears. This problem is compounded when public goods are involved (Adams & McCormick, 1993). If use or appropriation affects the supply and availability of the product, it can affect demand because of the rivalry issue.

For example, when there is a limited supply of a product—a physical DVD of the motion picture "Harry Potter and the Chamber of Secrets," for example—rivalry exists between consumers. Not all consumers will be able to acquire the DVD at the price they want because others are willing to pay a higher price and their purchase reduces the supply available. In virtual situations, supply does not have the same effect. When the film "Harry Potter and the Chamber of Secrets" is broadcast on television, viewing it in one household does not reduce the supply so that it cannot be viewed in another home. Thus, the rivalry and the price effects of rivalry disappear.

If a product is available in both physical and virtual form, it is possible to have cross-effects between them. Thus the ability to purchase the film as a DVD or to purchase it as a downloadable video file will affect both the physical and virtual markets. This needs to be taken into account in individual instances of loss analysis.

Content Appropriation Definitions

Appropriation of products protected by intellectual property rights takes place in different ways. Three main categories of appropriation are recognized—theft, infringement, and piracy—and the three are prohibited by general criminal and specific intellectual property right laws. The economic effects of appropriation in these forms will be discussed later in this article.

Definitions of these terms are critical because their use differs within and among common speech, policy documents, and legal texts, and national differences are compounded when international treaties are involved. This note uses specific definitions of appropriation so that the economic effects can be clearly illustrated.

Theft includes activities such as taking newspapers from sales racks without paying, hijacking shipments of audio recordings, and acquiring cable or satellite signals without payment (signal theft). It is an act of stealing designed to acquire the product without exchange, thus bypassing the marketplace. In law, theft of media products and services is typically punishable under general criminal law rather than laws protecting intellectual property rights.

Infringement represents the reproduction, distribution, display, or performance of a protected work that causes economic harm to the copyright holder and creates economic benefits for the infringer. Laws regarding infringement differ, and some nations provide more rights for personal use than do other nations. Most countries' laws provide civil and criminal penalties for infringement, but criminal penalties are usually applied only in cases of commercial use (dealt with as piracy in this analysis because of their differing economic effects). The relevant statutes are specific to intellectual property rights and not part of general criminal law as is the case in theft. In this article the term infringement is used to indicate noncommercial appropriation for personal use or sharing with others.

Piracy is a term applied to infringement for commercial gain and will be used in that sense in this article. Media that are most often the victims of piracy are motion pictures, audio recordings, cable networks, books, and computer games and software. Major forms of piracy include illegal duplication, counterfeiting, and unauthorized public performances. *Illegal duplication* is the making of copies of video, audio, or print products for commercial gain. Thus, a photocopying business that provides copies of this article for students in a course engages in illegal duplication for commercial purposes. Similarly, someone making copies of CDs and selling them to others engages in illegal duplication. Typically, the quality of these duplicated copies varies and they may not be represented as being authorized copies.

Counterfeiting is a type of illegal production and distribution in which illicit copies of video, audio, or print products are made for commercial sale and represented as genuine. These tend to be larger-scale, organized criminal operations in which high-quality copies and packaging are produced and the product is then sold to retailers for resale. *Unauthorized public performances* involve activities such as exhibition of films or videos to audiences without paying fees to the copyright holder.

Laws prohibiting the various forms of piracy are generally specific to intellectual and related property rights and treat them as special forms of theft or infringement.

Legal and Economic Aspects of Content Appropriation

Intellectual property laws are based on a philosophy that balances the need to compensate creators for their work and the need to serve society through dissemination of knowledge and cultural matter. The goal is to create a socially optimal price that is relatively low but still provides appropriate compensation. The philosophy and economics of copyright law are well discussed by Landes and Posner (1989) and Besen and Raskind (1991).

Issues of theft of content products have concerned industry associations but relatively little scholarly work has been devoted to the subject. Existing studies on these issues have focused on the necessity to consider dual products in measuring the value of theft involving newspapers (Picard & Lacy, 1999), differences in demand for original and copied content (Bessen & Kirby, 1989; Holm, 2002), and how banning digital audiotape use to protect recordings would produce substantial monetary losses to society (Mannering, 1994).

Other studies have found piracy rates are related to economic stability and growth potential of nations (Hogenbirk & van Kranenburg, 2002), enforcement of copyright creates captive markets in high value users (e.g., companies and institutions) by allowing producers to raise prices and increase profits but simultaneously increasing overall piracy rates (Harbaugh & Kemka, 2002), and improvements in information technologies alone do not provide a rationale for overcoming fair uses because of the effects of the number of copyright holders, complementarity between inputs, and price issues (Depporter & Parisi, 2002).

This note departs from previous analyses by describing how economic losses inherent in theft, infringement, and piracy are created and their implications for producers, consumers, and law and policy.

ECONOMIC LOSSES

The economic effects of theft, infringement, and piracy depend on the differences in the supply and demand sides of physical and virtual content products. These differences produce varying results in four important areas in which economic effects of appropriation can be observed: (a) effects on recovery of marginal costs, (b) effects on costs of authorized products available for sale, (c) effects on consumer demand, and (d) effects on company revenue.

In creating physical products, producers incur marginal costs in production and distribution because of the use of supplies and equipment in bringing the content to market. Appropriation of content products thus seizes that value. It is lost and not directly recoverable by the producer.

Appropriation also has effects on the producer's average cost, because it reduces the total number of copies over which costs are spread, thus raising the producer's average cost for the remaining copies. This reduces the producer's return unless price is raised, which affects demand and can reduce overall return.

On the demand side, appropriation may reduce rivalry and demand for the producer's product and can result in loss of revenues if they interfere with the existing market for the legitimate content product by reducing sales or price received. Because this note is concerned with losses, it focuses on issues related to loss of demand. In both economic theory and practice, however, it is recognized appropriated content can also increase demand for legitimate content.

Combining the three definitions of appropriation discussed here with the two types of products (physical and virtual) produces six conditions under which the four primary economic loss effects can be framed for analysis.

THEFT OF PRODUCTS

Theft involves the appropriation or taking of the property of others without their consent for personal gain and is based on the principle that an owner should not be deprived of the value of his or her property without consent and compensation. The impact of theft of content differs for physical and virtual products because of differences of costs in their value chains and thus the value of the product.

Theft of Physical Content Products

In cases of theft, the producer of physical products loses the marginal cost of production for the items taken and experiences an increase in average costs for the remaining items produced. The theft of a truckload of copies of John Grisham's novel *The King of Torts,* for example, leaves the publisher with uncompensated marginal costs for production of the copies taken by theft and this raises the average cost across the number of copies remaining.

The theft of the books may or may not reduce demand and revenue on the supply side, depending on the use made of them. The stolen books will reduce demand for the unstolen copies and deny revenue to those in the value chain only if the copies make their way back into the market and are purchased in place of copies for which producer compensation is made.

If the stolen copies of *The King of Torts* are burned as fuel for a power plant they will not have a similar market effect. If they are sold to consumers as stolen goods at a reduced price this may or may not affect sales through legal channels depending on whether the purchasers of the stolen copies would have bought the novel at the market price on the legal market. If they would have purchased on the legitimate market, rivalry will be affected and demand influenced. Demand for legitimate sales might also be affected if the producing firm raises its prices to gain additional revenue to recover the losses in marginal costs and overall demand for the book falls.

Theft of Virtual Content Products

With theft of virtual content products there is no loss of marginal cost of production and no increase in average cost for remaining units. This occurs because virtual content is not affected by unit cost economics but by fixed cost economics, because they are public goods for which the production necessary to produce content for one user is the same as the production for the cost of 10,000 users.

Signal theft, such as illicit acquisition of satellite signals, does not cause the producer to lose the marginal costs of production and distribution and does not affect average cost because physical units are not involved. Thus, bypassing encryption to acquire the Canal Plus signal does not affect costs for Canal Plus to create and provide its channel.

On the supply side, virtual goods are public goods, so the illicit acquisition of Canal Plus by a signal thief does not reduce its availability to another, because there is no rivalry among consumers for the product. The sale or use of the stolen virtual products, then, does not necessarily reduce demand and revenue on the supply side. It only reduces demand and revenue IF consumers of the stolen signal would have paid the price asked by the seller. If those who use the stolen product would not have purchased at the asking price, then it has no demand effect.

ISSUES IN INFRINGEMENT

Infringement is the unauthorized use of copyrighted material not otherwise permitted by fair use or compulsory licensing. As defined in this article, it is done by individuals for personal purposes or to share content with others.

Infringement of Physical Content Products

With infringement of physical content products, producers incur a loss on the marginal cost of product. The average costs for units sold rise IF sales for the product decline and the producer is left with unsold product attributable to the infringement. The infringement may or may not reduce demand and revenue on the supply side, depending on whether those using infringed copies would have purchased them at the price offered on the commercial market.

A cooking teacher who photocopies *Larousse Gastronomique* for his or her students acquires the content of the cooking encyclopedia without reproduction rights payment—thus obtaining an economic benefit—and denies compensation to the owner of the copyright. The infringement of the physical content product will have supply cost effects and demand and revenue effects only if individuals who received the copies would have actually paid to purchase the printed version. If they would not, however, rivalry for the existing printed copies is not affected and demand will not shift. The infringement denies revenue by not making a reproduction rights payment, but that loss will have no affect on the marginal or average cost of producing the original publication.

Infringement of Virtual Content Products

In cases involving virtual content, infringement causes no loss of the marginal cost of production and no increase in average costs for units sold, because unit cost economies are not applicable. On the supply side, infringement of virtual products may or may not reduce demand and revenue. The result again depends on whether users would have made purchases at the price offered in the commercial market for the content and whether rivalry is affected.

An individual who purchases the Foo Fighters' *One by One* CD and makes a copy to share with a friend creates no marginal and average cost effects to the record firm. The infringement can only produce demand and revenue effects if the user or friend substitutes the infringed copies for legitimate copies they would have otherwise purchased. If the friend would not have purchased a legitimate copy, rivalry and demand and company revenue are unaffected.

ISSUES RELATED TO PIRACY

As indicated earlier, piracy is infringement deliberately undertaken for commercial purposes. It is designed to reap financial benefits that should have otherwise gone to the producer.

Piracy of Physical Products

Because the pirate undertakes manufacturing and distribution, the original producer suffers no loss of marginal cost of production for its copies and average costs of the units it produces are unaffected. On the demand side, piracy does not necessarily reduce demand and revenue unless purchasers substitute the original content with the pirated content.

Thus, the production of illicit DVD copies of Roman Polanski's *The Pianist* for commercial purposes does not affect the marginal cost and average costs of the legitimate producer unless the producer is left with unsold copies directly attributable to the availability of the pirated copies. Similarly, demand for the legitimate copies and revenue effects occur only if the consumers of the pirated copies would have purchased at the offered price for legitimate copies and thus rivalry for the remaining legitimate copies is reduced.

It must be recognized pirates incur production and distribution costs and separate market and demand function exists for pirated products. These are outside the scope of this note, which focuses on effects on legitimate producers.

Piracy of Virtual Products

In cases involving piracy of virtual content, there is no loss of marginal cost of production and no increase in average costs for units sold because virtual media operate in fixed rather than unit cost economies. Because there is no inventory of the product, marginal costs and average costs are not affected even if legitimate sales decline. The piracy of virtual products, however, may or may not reduce demand and revenue.

Thus, piracy of virtual products—such as the illicit sale of downloads of Metallica's *St. Anger* to an audiotape, writable CD, or MP3 player (a form of piracy found in a number of nations)—have no effect on the marginal costs or average costs of the legitimate producer but may affect rivalry and demand for the legitimate copies and overall revenue if the consumers of the pirated files would have purchased them at the price offered for legitimate copies.

DISCUSSION

This article has focused on the economic losses inherent in theft, infringement, and piracy and has shown that they produce varying results. The differences are summarized in Table 1.

The table reveals an abundance of "sometimes" effects. This might lead some to assume the analysis does not provide an effective result. However, this analysis is significant, because it shows that negative effects of losses are rarely inevitable. Thus, arguments that theft, infringement, and piracy *necessarily* produce economic losses to firms are not supported. In fact, conditions in which unauthorized uses may "sometimes" produce economic losses may also produce no economic losses to the content producer. The determination of effect must be case specific.

TABLE 1
Summary of Effects of Losses in Different Situations

Variables	*Effect on Marginal Costs*	*Effect on Average Costs*	*Effect on Demand*	*Effect on Revenue*
Theft of physical content product	Yes	Yes	Sometimes	Sometimes
Theft of virtual content product	No	No	Sometimes	Sometimes
Infringement of physical content product	Sometimes	Sometimes	Sometimes	Sometimes
Infringement of virtual product	No	No	Sometimes	Sometimes
Piracy of physical content product	Sometimes	Sometimes	Sometimes	Sometimes
Piracy of virtual content product	No	No	Sometimes	Sometimes

Only in cases of outright theft of physical products is there clearly an effect on costs on the supply side and in no cases is there an absolute effect on the demand side. In most cases there are no cost or demand effects or only the *potential* for cost or demand effects from appropriation. In only a third of the cases is the outcome deterministic and in only two cases is it negative. For two thirds of the conditions, only the potential for losses exists from appropriation of content products, and determining whether there are losses needs to be made on case-by-case basis. This is particularly critical because the degree of potential for loss varies across the "sometimes" cases.

It must also be recognized that illegitimate uses of copyright products also have the potential to increase demand of authorized products. Uncompensated downloads of a product, for example, can have sampling effects in that users may test content, determine whether they like it, and then purchase legitimate versions that they might not have otherwise purchased.

It is interesting to note that despite the fact that the least opportunity for damage occurs in the cases of theft, infringement, or piracy of virtual products, laws are increasingly providing greater protection and higher penalties for appropriation of virtual rather than physical content products in which losses are inevitable.

This leads to questions about the rationales for this difference, primarily because they have not been, and are not being, clearly articulated in legislative debates. The strengthened laws have apparently been passed or offered because of the ease of digital theft, infringement, or piracy. Given that the potential costs associated with these uses of virtual products primarily result from effects on the demand side—whereas physical products incur losses and loss potential on both the supply and demand side—the justifications for the incrementally larger penalties in virtual products should be transparent and clearly stated.

Contemporary legal measures to provide increased production for virtual products represent the use of law to heighten excludability, but in doing so, they run the serious risk of destroying the recognized social benefits of the development and spread of information, knowledge, and cultural products previously recognized in all copyright law.

Because of the difference in losses and potential for losses from unauthorized uses of copyrighted products, legal and policy responses should not be the same or follow the same template for each condition of theft, infringement, or piracy. The problems associated with each have different roots and the legal and policy responses will produce differing results under the given conditions.

REFERENCES

Adams, R. D., & McCormick, K. (1993). The traditional distinction between public and private goods needs to be extended, not abandoned. *Journal of Theoretical Politics*, *5*(1), 109–116.

Besen, S., & Kirby, S. N. (1989). Private copying, appropriability, and optimal copying royalties. *Journal of Law and Economics*, *32*(2), 255–281.

Besen, S., & Raskind, L. (1991). An introduction to the law and economics of intellectual property. *Journal of Economic Perspectives*, *5*, 3–27.

Brenner, R. (1990). *Rivalry: In business, science and among nations*. Cambridge, England: Cambridge University Press.

Bronfenbrenner, M., Sichel, W., & Gardiner, W. (1990). *Microeconomics* (3rd ed). Boston: Houghton Mifflin.

Depoorter, B., & Parisi, F. (2002). Fair use and copyright protection: A price theory explanation. *International Review of Law and Economics, 21*(4),453–473.

European Union, Directive 2001/29/EC of the European Parliament and of the Council of 22 May 2001 on the harmonisation of certain aspects of copyright and related rights in the information society. *Official Journal L 167 , 22/06/2001*

Gaustad, T. (2002). The problem of excludability for media and entertainment products in new electronic market channels. *Electronic Markets*, *12*(4), 248–251.

Harbaugh, R., & Kemka, R. (2002). *Does copyright enforcement encourage piracy?* (Claremont Colleges Working Papers in Economics, No. 2002-14). Claremont, CA; Claremont Colleges.

Hogenbirk, A. E., & van Kranenburg, H. L. (2002, May 9–11). *Determinants of multimedia, entertainment, and business software copyright piracy and losses: A cross-national study.* Paper presented to the 5th World Media Economics Conference, Turku, Finland.

Holm, H. (2002). *The computer generation's willingness to pay for originals when pirates are present—A CV [contingent valuation] study* (Scandinavian Working Papers in Economics, No. 2002-9). Lund, Sweden: Department of Economics, University of Lund.

Kuenne, R. E. (1998). Price and nonprice rivalry in oliogopoly: The integrated battleground. Basingstoke, Hampshire, United Kingdom: Palgrave Macmillan.

Landes, W., & Posner, R. (1989). An economic analysis of copyright law. *Journal of Legal Studies*, *18*, 325–363.

Mannering, F. L. (1994). Assessing the impact of audio home copying restrictions. *Quarterly Journal of Business and Economics*, *33*(1), 30–165.

Picard, R. G., & Lacy, S. (1999). Legal and economic aspects of theft of newspapers: Using a model of newspaper value. *Journal of Media Economics*, *12*(4), 247–263.

United States (1934). Section 633. *Communications act of 1934.* 47 USC 533.

United States (1934, 1996). Section 705, *Communications act of 1934*, as amended by the *Telecommunications act of 1996* (47 USC 605).

United States (1998). *Digital millennium copyright act*. Public law (105–304).