Copying and Copyright

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Today most newly created textual, photographic, audio, and video content is available in digital form. Even older content that was not "born digital" can relatively easily converted to machine-readable formats. At same time, the world has become more networked, making it easy to transfer digital content from one person to another. The combination of technological progress in both digitization and computer networking has been a challenge for traditional ways of managing intellectual property. Some observers have even questioned whether current models for intellectual property can or should survive in a digital world.

For example, there is widespread concern about piracy of popular music and film, both via the network and via bootleg CDs and DVDs. There is also concern about the economic viability of the current model for scholarly publication, or, for that matter traditional forms of publishing such as newspapers and TV network news.

These developments have led to a revival of interest in the economics of copying and copyright.[1] In this brief review we examine some of the economic issues in this area, and describe some of the insights that have emerged from this work. We end with some reflections on alternative business models for provision of creative works.

A brief history of copyright

The origins of copyright date back to seventeenth century England. Prior to the invention of the printing press in the late fifteenth century, the English royalty controlled information dissemination by punishing dissenting authors. After the arrival of the printing press, the locus of control shifted to the publishers, and royal declarations required printers to display their names, cities and dates of publication on each work.

Several publishers banded together to form the Stationers Company, which in 1662 was given the exclusive right to practice the "mistery or art" of printing, in exchange for the obligation to publish only those works approved by Parliament. The Stationers were given the right to enforce their monopoly by burning the books and presses of any unauthorized competitors. In order to keep track of authorized works, the Stationers created a registration scheme which was a precursor to the system of copyright registration.

The English censorship laws expired in 1694, and the Stationers lobbied for relief from the harsh competitive environment in which they found themselves. The response was the Copyright Act of 1709, also known as the Statute of Queen Anne, which awarded the right to control copies to the author of a work for a period of 14 years, which could be renewed for another 14 years.

The framers of the U.S. Constitution recognized the beneficial incentives offered by such a copyright system and unanimously included a clause indicating that "the Congress shall have power ... to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries."

The U.S. Copyright Act of 1790 was modeled on the Statute of Queen Anne, and offered a 14-year monopoly to *American* authors, along with a 14-year renewal. Note carefully the emphasis on "American." Foreign authors' works were not protected by the American law. In contrast, many other advanced countries such as Denmark, Prussia, England, France, and Belgium had laws respecting the rights of foreign authors. By 1850, only the US, Russia and the Ottoman Empire refused to recognize international copyright.[2]

The advantages of this policy to the US were quite significant: they had a public hungry for books, and a publishing industry happy to provide them. A ready supply of market-tested books were available from England. Publishing in the US was virtually a no-risk enterprise: whatever sold well in England was likely to do well in the US.

American publishers paid agents in England to acquire popular works, which were then rushed to the US and set in type. Competition was intense, and the first to publish had an advantage of only days before they themselves were subject to competition. As might be expected, this unbridled competition led to very low prices: in 1843 Dickens's *Christmas Carol* sold for six cents in the US and $2.50 in England.[3]

However, there were some mitigating factors. Publishers sometimes paid well-known English authors for advance copies of their work since priority was critically important for sales and, according to Plant [1934], some English authors received more money from American sales, where they held no copyright, than from English sales, where copyright was enforced.

Throughout the nineteenth century, proponents of international copyright protection lobbied Congress. They advanced five arguments for their position: (1) it was the moral thing to do; (2) it would help stimulate the production of domestic works; (3) it would prevent the English from pirating American authors; (4) it would eliminate ruthless domestic competition; and, (5) it would result in better quality books.

The rest of the world was far ahead of the United States in copyright coordination. In 1852 Napoleon III issued a decree indicating that piracy of foreign works in France was a crime; he was motivated by the hope of reciprocal arrangements with other European countries. His action led to a series of meetings, culminating in the Bern conventions of 1883 and 1885. The Bern copyright agreement was ratified in 1887 by several nations, including Great Britain, France, Germany, and Spain ... but not the United Stats.

It was not until 1891 that Congress passed an international copyright act. The arguments advanced for the act were virtually the same as those advanced in 1837. However, the intellectual climate was quite different. In 1837 the US had little to lose from copyright piracy. By 1891 it had a lot to gain from respecting international copyright, the chief benefit being the reciprocal rights granted by the British.

On top of this was the growing pride in homegrown American literary culture and the recognition that American literature could only thrive if it competed with English literature on an equal footing. Although the issue was never framed in terms of "dumping" it was clear that American authors and publishers pushed to extend copyright to foreign authors in order to limit cheap foreign competition-such as Charles Dickens.

The only special interest group that was dead opposed to international copyright was the typesetters union. The ingenious solution to this problem was to buy them off: the Copyright Act of 1891 extended protection only to those foreign works that were typeset in the US! This provision stayed in place until 1976.

Since the 1890s, there have been several developments in the type of content deemed protectable by intellectual property laws. For example, in 1909, the US Copyright Act was revised to extend protection to all works of authorship, including music. So sheet music, for example, became copyrightable. But what about player piano rolls? The same act offered a new form of intellectual property protection, mechanical reproduction rights, to deal with this new technology. This form of protection was subsequently applied to phonographs, audio tapes, and CDs. The mechanical reproduction fee which is paid to copyright owners is a form of "compulsory license," and is set by Congress every 10 years. It is currently 6.95 cents per song, or 1.3 cents per minute.

The owners of intellectual property in music also have "performance rights," which cover public performances, "print rights," which covers the score, "grand rights," which covers musical theater, and "synchronization rights," which cover background music in a film. Music is but one example of how copyright has been extended to cover new communication technologies. Radio, television, audio tape, web pages, computer software: as each new technology copyright law has been extended to deal with it. [[http://www.musiceducationmadness.com/copyright1.shtml]]

The US was a developing country in the nineteenth century, and it was hardly surprising that it found it attractive to free ride on the intellectual products of other, more developed countries, such as Britain. The same phenomenon can be observed today. Figure 1 depicts estimates of the amount of pirated software versus per capita GDP. The pattern is apparent: lower per capita GDP is associated with a higher fraction of pirated software. The history of the United States recounted above suggests that increased per capita income will likely lead countries to increased adherence to international intellectual property norms.[4]
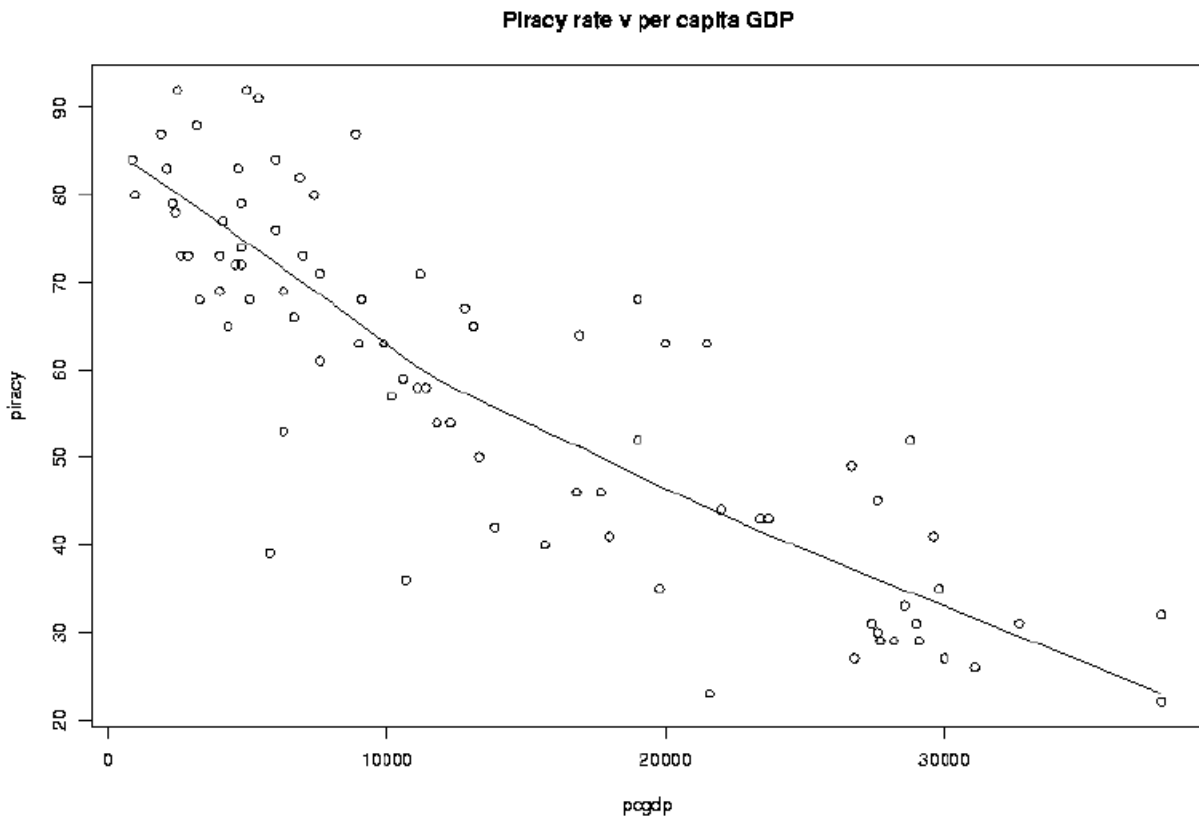
Piracy rate v per capita GDP

Figure 0.1: Per-capita income v fraction of software that is pirated for various countries. Source: Business Software Alliance and the CIA World Fact Book. (Business Software Alliance [2004] and CIA [2004])

Parameters of intellectual property protection

Intellectual property protection generally has three dimensions: length, width, and height.

The "height" is the standard of novelty required for a work to be protected. For copyright, the standard of novelty is very low-virtually anything one creates is automatically copyrighted when it is "fixed in tangible form." It is important to understand that neither copyright or patents offer intellectual property rights for *ideas*. Rather it is the *expression* of ideas that is subject to copyright.

One does not have to put a notice of copyright on a work for it to be protected. However, doing so confers some legal advantages in case of a subsequent infringement suit. The U.S. Copyright publication on *Copyright Basics* offers a useful introduction to the mechanics of copyright law and practice. (US Copyright Office [2003].)

The "width" of intellectual property protection refers to the breadth of coverage that the protection offers. As indicated above, copyright is relatively narrow in that it is only the expression that is protected; it does not protect facts, ideas, concepts, or methods of

operation. Furthermore, under certain conditions, extracts from works that have been copyrighted may be reproduced. The US Copyright Act of 1976 indicates that reproductions for purposes such as "criticism, comment, news reporting, teaching (including multiple copies for classroom use), scholarship, or research, is not an infringement of copyright."

This "fair use doctrine" is essentially a *defense* against an infringement claim and US law indicates several factors that can be taken into account in such a defense, including the purpose of the use, the nature of the work, the proportion of the work copied, and the economic impact of the use on the market. The fair use exemption is notoriously vague, but perhaps intentionally so, as it allows the law to deal flexibly with cases as they arise.

Although copyright protection is quite narrow in scope, it can in certain circumstances serve as an effective barrier to entry, particularly in industries where there are large switching costs. Consider, for example, a user interface, such as a choice of keystrokes to implement various actions in a software program. Should this sort "expression" be subject to copyright protection?

One could argue that that the choice of user interface is essentially arbitrary and that there would be little harm from allowing copyright protection. But if a particular user interface becomes widely adopted, and there is switching cost to users if they change interfaces, copyright protection for user interfaces can serve as an entry barrier to new and potentially superior software.

This argument was advanced by Farrell and Woroch [1995] in the case of *Lotus v. Borland*; see Farrell [1995] and Baseman et al. [1995] for further development. The U.S. Supreme Court deadlocked on the issue of whether user user interfaces were copyrightable in the *Lotus v. Borland* case, so the legal status of user interfaces is still up in the air.

Finally, the "length" of intellectual property protection refers to the term of copyright. Unlike the other two dimensions, the length of copyright is easily quantified.

The optimal term of copyright

The simplest possible model for the term of protection of intellectual property compares the social benefits and costs that accrue under two regimes: the protected period, when copyright is enforced, and the unprotected period, when the work is in the public domain.

Let us suppose that various works can be created, each of which has the same value to users. Think of romance novels, or pop songs, or whatever unimaginative, repetitive genre you prefer. (Of course, economics textbooks could not be considered as examples of this sort.)

The longer the term of copyright protection, the larger is the present value of the revenue stream from the work. Letting T denote the copyright term, we write the number of works that will be created as n(T). Clearly, this is an increasing function of the copyright term, T.

Let U_M be the benefits per period that accrue to consumers under monopoly pricing and let $U_C > U_M$ be the benefits that accrue to the consumers per period when the intellectual

property is competitively supplied. The present value of welfare is the sum of the welfare over the protected and unprotected period. Once the work has been created, total welfare in the competitive regime exceeds that of the monopoly regime.

If the term is increased to T+ΔT, society loses the benefits from competition that would have accrued during the period ΔT. On the other hand, extending the term makes the production of intellectual property more profitable, increasing the supply of works. The optimal term balances out these two effects. In other words, at the optimal term, the marginal value of the incremental piece of intellectual property will equal the social cost of the delayed availability of the property that has already been created.

Much more elaborate models of this sort have been developed by Nordhaus [1969] for patents, and by Landes and Posner [2003] for copyright. Unfortunately, there are few theoretical insights that emerge.

It is important to recognize that works are not only outputs of the creative process but are also inputs. Increasing the number of creative works presumably stimulates the production of yet more such works. This point has been forcibly made by Scotchmer [1991] in the case of patents, but it applies equally well to copyright. We should interpret the social benefits from the creative works in the above analysis as a net benefit, taking into account this stimulant effect.

Recent extensions to the copyright term

As mentioned above, the initial term of copyright in the United States was for 14 years. In the United States the term of copyright was lengthened to 28 years in 1831, with a 28 year renewal option added in 1909. In 1962 the term became 47 years, and 67 years in 1978. In 1967 the term was defined as the life of the author plus fifty years, or 75 years for "works for hire." The 1998 Sonny Bono Copyright Term Extension Act lengthened this term to the life of the author plus 70 years for individuals and 75-95 years for works for hire.
[[http://en.wikipedia.org/wiki/Sonny_Bono_Copyright_Term_Extension_Act]]

Some might question whether 95 years should really be considered as consistent as a "limited time" as described by the U.S. Constitution. In Akerlof et al. [2002], seventeen economists (of which I was one) argued that the economic benefits of the 20 year extension were trivial. A simple present value calculation shows that at a 7% rate of interest, the value of a twenty-year extension is about 0.33 percent of the present value of the first 80 years of copyright protection.

This is a very conservative calculation, as it assumes a constant flow of returns from the intellectual property. In reality there are very few works that produce such a royalty stream. Fewer than 11 percent of the copyrights registered between 1883 and 1964 were renewed after 28 years. Furthermore of the 10,027 books published in 1930, only 174 were still in print in 2001.(Landes and Posner [2003], p.212) The interest rate of 7% is also very low, given the riskiness of the income stream from copyrighted works. But the conclusion is not very sensitive to this choice-even relatively low interest rates give very little weight those last twenty years.

But if the extension was worth so little to the owners of copyright, why would anyone bother to extend the term? The answer is that the copyright term was extended *retroactively* so that existing works that were near expiration were given a new lease on life. For example, it has been widely claimed that Disney lobbied heavily for the copyright term extension, since the original Mickey Mouse film, "Steamboat Willie" was about to go out of copyright.

Retroactive copyright extensions in this way makes no economic sense, since what matters for the authors are the incentives present at the time the work is created. If there were no such grandfathering it is unlikely that anyone would have bothered to ask for copyright extensions.

Liebowitz and Margolis [2003] offer a critique of the 17 economists' position. They point out that one can construct examples where the supply curve of creative works is sufficiently elastic that a small increment in copyright benefits induces a substantial increase in output. More interestingly, they present some empirical evidence that best-sellers were in a given year were likely to remain in print for a long time. In their sample of bestsellers published in the 1920s more than half remained in print after 58 years.

However, one must still ask how much incentive is created by the revenue received 58 years after publication. In all likelihood it is rather small. Furthermore, works that are still read after 58 years would likely have sufficient merit that their movement into the public domain would create substantial social benefits. The fact that a few books have long lives seems to cut both ways with respect to copyright extensions.

Landes and Posner [2003] argue the case for an indefinite but renewable copyright term. As they point out, a system for renewals would require the government to maintain an up-to-date copyright registry. Since copyright registration is not currently required of authors, it can be very costly to locate the legal holders of a copyright. the availability of a registry would dramatically reduce the transactions costs of licensing. Surely a registration requirement is a minor burden on authors in exchange for a likely very substantial benefit to those who seek to republish that author's work. Given today's technology, the creation of a "universal" copyright registry, perhaps in exchange for some incremental benefits to authors, would be highly attractive.

Other terms and conditions

Copyright is, specifically, a prohibition against copying a work. What about loaning a work, or selling a used copy? What about home copying for personal use? What about quoting a work, or satirizing a work?

The last two uses of a work run up against free speech issues, and are normally counted as "fair use." For example, in Campbell v. Acuff-Rose Music, Inc. (1994), the Supreme Court found that the rap song by 2 Live Crew did not infringe on Roy Orbison's song "Pretty Woman," since it was a parody. [[http://www.publaw.com/parody.html]]

Home copying for personal use of TV broadcasts has been held to be legal by the US Supreme Court in *Sony v. Universal Studios* (64 U.S. 417 [1984]), sometimes called the

"Betamax case." Home copying is also explicitly allowed for certain other sorts of purchased works.

Loaning a work generally falls under the "doctrine of first sale," which allows the purchaser of a work subsequently to do with it what he desires. This doctrine gives a legal basis for libraries and other forms of institutional sharing. Renting a work falls under the same doctrine. In the early history of the video tape, the movie industry floated some trial balloons about licensing tapes for purposes of sale or rental, but these never went very far since the doctrine of first sale was presumed to apply to video tapes. (See Lardner [1987] for an account.)

The right of first sale can be modified by legislative or judicial action. In the US, you cannot legally rent software or music CDs but you can rent DVDs and prerecorded video and audio tapes (see the Copyright Act, 17 USC 17 USC Sec. 109, "Limitations on exclusive rights: Effect of transfer of particular copy or phonorecord," available at `http://www.megalaw.com/top/copyright/17usc109.php`.) Though you can photocopy articals from a journal that you have purchased for your own use, an employee of a company may not be able to photocopy an article in a journal that the company has purchased for its library. (*American Geophysical Union v. Texaco*, No. 92-9341 (2d Cir. October 28, 1994). However such restrictions do not appear to apply to educational institutions.

As these examples illustrate, there are many points in intellectual property law that may strike economists as peculiar. Over the years copyright law has evolved in somewhat haphazard ways to meet the challenges of new technologies and business developments; so far it has succeeded in meeting this challenges.

As indicated earlier, the purchase or licensing of a work may involve a whole set of terms and conditions regarding its subsequent use. We might well ask what economic factors determine these terms and conditions.

Imagine a world where a music publisher, say, can completely determine the terms and conditions under which the products it sells can be consumed. For example there might be some perfect "digital rights management" system that allows them to enforce restrictions against copying, resale, rental, and so on.

We must distinguish between the number of works produced (x) and the number consumed (y), due to the fact that works may be shared, for example. Initially, let us suppose that there is no copying so that the number of works produced (x) and the number consumed (y) are equal. Compare this situation with a more permissive set of terms and conditions which will allow some copying to occur, so that the amount consumed can exceed the amount produced.

In this case, the producer is likely to sell fewer units of the work. However, it can likely sell those units at a higher price, because the consumers receive greater value from the work, having more permitted uses for the work. Allowing greater freedom to copy will increase seller profits if the value to the marginal consumer (and thus the increased price that the firm can charge) more than offsets the loss of sales.

The important point that the price will respond to more liberal conditions (specifically the right to copy) was first pointed out by Liebowitz [1981]; he called this the concept of *indirect appropriability*. In this same report, parts of which he later published in Liebowitz [1985], he presented empirical work that suggested that academic journals raised their prices after photocopying because they had become more valuable to users.

This is a very intriguing finding. One might also suggest that online copies of journals are even more valuable to users, and one explanation for recent journal price increases is the attempt to capture some of that additional value.

To take another illustration of indirect appropriability, imagine a world with 100 identical consumers of CDs. Each consumer would be willing to pay $20 for home use and $9 for the convenience of playing an additional copy of the CD in the car. If the seller can pick only one price, it would pick $20 and consumers would only have home use of the CDs. But if each consumer had the right to make a single additional copy then the seller could extract $29 from each consumer, making substantially more money.[5]

One could enhance this model by adding in "leakage:" some consumers could sell their "extra" CDs to others, reducing demand for the bundled product. But the same basic idea described above holds: if the willingness-to-pay for the right to copy exceeds the reduction in sales, the seller will increase profit by allowing that right.

There are many variations on this model described in papers by Liebowitz [1985], Besen [1986], Varian [2000] and others. Some of the variations explored are:

- There may be transactions costs to making copies, or the copies may be inferior to the original.

- The item may be shared among different sized groups.

- The size of the group may influence the transactions costs-i.e., the larger the group sharing a DVD, the longer you have to wait for your chance to view it.

- The willingness to pay for the item might depend on the sum of the willingnesses to pay of the individuals within a group rather than the willingness to pay of the marginal individual.

However, it is also worth pointing out that the indirect appropriability has limits. Suppose that some of the 100 CD consumers buy a copying machine and churn out hundreds of copies. Competition pushes the price of a bootleg CD to marginal cost and the seller is cannot recover the costs of production at the $20 price.[6] Of course, it could raise the price, but that makes purchase of the bootleg copies even more attractive. I explore a model of this phenomenon in the next section.

Price setting in the presence of copying

As we have seen, copyright law confers a temporary monopoly to authors of works. However, enforcing copyright may be quite difficult, and it is worthwhile examining outcomes in the presences of various sorts of copying, sharing, renting, resale and the like.

Let us examine a very simple model of cost sharing among a fixed-size group of k individuals. Assume that there is some transactions cost of sharing (i.e., waiting your turn, inferior copies, returning the book to the library or CD to the rental store, etc.). Due to these transactions costs the k individuals each value the unshared item at v, but the shared item at v−t. The seller sets a price p, and the buyers compare the utility of buying to sharing. If

$$v - \frac{p}{k} - t > v - p, \tag{0.1}$$

the buyers would prefer to share rather than buy. Given that that the the buyers share, the monopolist will set a price that just makes each individual in the group just willing to purchase:

$$v - \frac{p}{k} - t = 0. \tag{0.2}$$

The price to the group will then be $p = k(v-t)$ so that the monetary price each person has to pay is v−t. Plugging this group price back into expression (1), we see that the sharing outcome will occur when

$$v > kt/(k-1). \tag{0.3}$$

Hence large groups sizes, large value for the work and low transactions costs will lead to sharing.

Note that this solution is socially inefficient. In equilibrium the consumers get zero surplus whether they share or not, but the monopolist gets lower profit under sharing due to the inefficient sharing technology.[7] The inefficient arises because the monopolist can produce at zero marginal cost, but the consumers pay a positive transactions cost to share.

Note the perverse dynamics in this model. If the monopolist initially sets a price slightly below v, which would normally be adequate to induce purchase, it will also encourage the consumers to share, as long as condition 3 is satisfied. As the consumers begin to share, the monopolist will want to raise its price, providing even stronger incentives to share. In the final equilibrium, the consumers end up with zero surplus and an inferior product, due to the transactions cost, and the monopolist ends up with less profit than in the no-share equilibrium.

A clever monopolist might well think about ways to avoid this vicious circle. One way is for it to use pre-emptive pricing and set an initial price low enough to discourage sharing. This is a type of limit pricing, where the intent is to discourage entry of a certain type of competitor-user copying of the product.

The maximum price that just discourages sharing is $p_n = tk/(k-1)$. In the sharing equilibrium, the monopolist makes v−t per consumer. In the limit-pricing equilibrium the monopolist makes tk/(k−1) per consumer. A little algebra shows that the limit-price equilibrium is more profitable than the sharing equilibrium when

$$\frac{2k-1}{k-1} \, t \approx 2t > v. \tag{0.4}$$

In the limit-pricing equilibrium the surplus is shared between the monopolist and the consumer. Again, this is due to the fact that the possibility of sharing operates like a competitor for the monopolist, constraining the price that it can charge. Since the monopolist's price and profit is increasing in the transactions cost of sharing, the monopolist would like these transactions costs to be as large as possible. Hence, it would be interested in seeing greater enforcement of antipiracy laws, technologies that make it costly to copy, and similar measure that make copying more costly to consumers.

Heterogeneous values

In the above analysis we assumed that all individuals had the same value for the work. When individuals have heterogeneous valuations for the work, the decision about whether to acquire a work that can subsequently be shared becomes a non-trivial public good problem. If k consumers share the item among themselves, what is the group demand function?

There are (at least) two answers offered in the literature. One suggestion, put forth by Armstrong [1999], Bakos et al. [1999], and Bergstrom and Bergstrom [2004] is that the willingness to pay by the group is the sum of the willingnesses to pay of the individuals. That is, the group has some way to "solve" the public goods problem and elicit contributions from the members that cover the cost of the item being purchased whenever the sum of the valuations is greater than that cost.[8]

This specification makes sense for, say, household members jointly trying to decide whether to purchase a DVD, or a librarian that is trying to decide whether to buy a book for the patrons of the library. To the extent that the librarian is familiar with the tastes of the patrons, the relevant number is the sum of the valuations of the borrowers.

The other specification, proposed by Varian [2000] is that the item will only be purchased if the value to the member of the group that values the item least exceeds the cost that he or she has to pay. This is motivated by a sharing institution like a video rental store. The store has to set a uniform rental price, and that price must reflect the value of the marginal purchaser.

To see the difference between the two valuation assumptions, suppose that the individual valuations are (1,2,3,4). As above, it may be cheaper for individuals form groups in order to purchase a single copy and share than it would be for each to purchase a copy. As we have seen this depends on the transactions cost of sharing and the pricing policy of the seller.

Let us suppose that the first two individuals and the last two individuals form "buying clubs," with individual valuations (1,2) and (3,4). Under the "library" assumption assumption, the two groups would have willingnesses-to-pay of 3=1+2 and 7=3+4, respectively; under the "video store" assumption the two groups would have willingnesses to pay of 2=2min(1,2) and 6=2min(3,4), respectively.

Video store model

Suppose that consumers get utility from viewing a video and that the inverse demand function for viewing is given by p(x). If the marginal cost of the video is c, then the monopolist will choose output x^* to maximize profit, $p(x)x - c\,x$.

Suppose now that groups of size k form so that if x items are produced, there will be y=kx items viewed. The willingness to pay of the marginal individual is p(kx), so the willingness to pay of the marginal group is kp(kx). The monopolist now wants to chose x to maximize $kp(kx)x - c\,x$. If c=0, then $y^*=kx^*$. That is, the monopolist just produces $1/k^{th}$ as much when sharing is possible, and the marginal user ends up paying the same amount as he or she did before.

When c > 0, the monopolist produces less when sharing is allowed, and makes more profit, due to the savings on production costs. Think of a situation where the users band together to form a private library and purchase some very expensive reference book. The publisher is better off printing a few of them and selling them to libraries at a high price that printing more and selling to every individual. In this case, sharing is a more efficient industry for selling downstream, so the monopolist wants to encourage downstream sharing.

However, note that we have assumed that there is no cost to sharing. In reality, it is often inconvenient to share due to various forms of congestion. We could modify the above model by adding in a transactions cost of sharing, as was examined earlier. This task is pursued in Besen [1986] and Varian [2000], among others.

The library model

In the library model, the value that a group of consumers places on the information good is the sum of the values of the individual members. Suppose that we have n consumers who form n/k groups of size k. To be concrete, let us suppose that individual values are Normally distributed. The group values will then be the sum of k Normal random variables. Figure 2 shows per capita demand curves for k=1,2,3 ... for an example with a mean price of $20 and a variance of $15/k.

As can be seen in this example, as the size of the group increases, the demand curve becomes flat at the mean value of $20 This is just the law of large numbers: the distribution about the mean shrinks as the sample size increases. Hence, for large groups, the seller should a per capita price at the group average and ends up extracting most of the consumer surplus. See Armstrong [1999], Bakos et al. [1999], and Bergstrom and Bergstrom [2004].
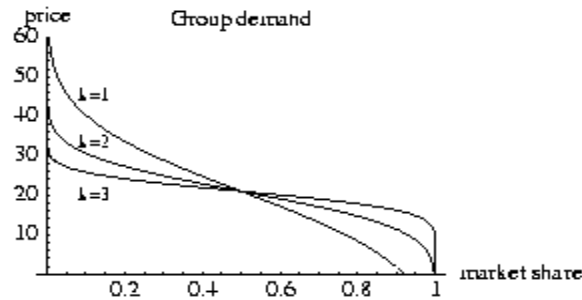
Figure 0.2: Demand curves by groups.

The library model has a few difficulties. In the limit, there should just be one big group and the seller should make a single take-it-or-leave it offer to the group. Obviously, this is unrealistic, but it shows that some attention should be given to the group formation issue.

In particular, it is clear that the assumed group formation method (random) is too simplistic. One might well ask what would happen if the groups formed more strategically.

The "video store" model probably goes too far in the other direction, as it assumes pure assortive mating-groups form among members with similar willingnesses to pay. Examining more flexible models of group formation may be an attractive avenue for future research.

In the above models, the price of the shared item adjusted so as to reflect the value that the group placed on it. This makes sense for institutional purchases (such as libraries), video rental stores, and the like.

However, it may not be a very good model of phenomena such as online file sharing. It is likely the case that the file sharers do not get huge personal benefits from sharing but it is so cheap and easy to do that they engage in sharing even if offers little additional personal utility. Perhaps their motives depend on some feelings of "contributing" to the group. Andreoni [1990] has analyzed a model of public good contributions that depend, in part, on the "warm glow" of giving.

If this behavioral assumption is correct, then even modest costs to sharing (congestion, threats of legal action, and so on) could be enough to discourage such activity. However, the problems of detection are difficult, and attempt to single out a few consumers for punishment have not thus far been very successful in discouraging online sharing.

Business models

As I noted in the introduction, most information is born digital and that digital information is typically very easy to copy and distribute, it is conceivable that copyright laws may become almost impossible to enforce. Are there ways for sellers to support themselves in such an environment? It is worth considering some of the options. Here is a brief list of business models that might work in a world without effective copyright.

Make original cheaper than copy.

This is basically the limit pricing model described earlier. If there is a transaction cost for a copy-a direct cost of copying, an inconvenience cost, or the copy is inferior to the original in some way-then the seller can set the price low enough that it is not attractive to copy.

Make copy more expensive than original.
The "cost of copying" is partially under the control of the seller, who could use a "digital rights management system," some anticopying technology, or threats of legal action which would increase the cost of copying and, therefore, increase the price that it could charge for its product.

Sell physical complements.
When you buy a physical CD you get liner notes, photos, and so on. Perhaps you could get a poster, a membership in a fan club, a lottery ticket, a free T-shirt, as well. These items might not be available to someone who simply downloaded an illicit copy of a song.

Sell information complements.
One can give away the product (e.g., Red Hat Linux) and sell support contracts. One can give away a cheap, low-powered version of some software and sell a high-powered version.

Subscriptions.
In this case, consumers purchases the information as a bundle over time, with the motivation presumably being convenience and perhaps timeliness of the information delivery. Even if all back issues are (eventually) posted online, the value of timely availability of current issues is sufficient to support production costs.

Sell personalized version.
One can sell a highly personalized version of a product so that copies made available to others would not be valuable. Imagine, for example, a personalized newspaper with only the items that you would wish to read. Those with different tastes may not find such a newspaper attractive. Selling works with digital fingerprints (encoding the identity of the purchaser) is an extreme form of this. (*Playboy* has allegedly put digital fingerprints in online images.)

Advertise yourself.
A downloaded song can be an advertisement for a personal appearance. Similarly, an online textbook (particularly if it is inconvenient to use online) can be an advertisement for a physical copy. There are many examples of materials that are freely published on the Internet that are also available in various physical forms for a fee, such as US Government publications (e.g., *The 9/11 Commission Report*, or the National Academy of Sciences reports.

Advertise other things.
Broadcast TV and radio give away content in order to sell advertisements. Similarly, most magazines and newspapers use the per copy price to cover printing and distribution, while editorial costs are covered by advertising. Advertising is particularly valuable when it is closely tied to information about prospective buyers, so personalization can be quite important. In an extreme form, the advertisement can be completely integrated into the content via product placement.

Monitoring.

ASCAP monitors the playing of music in public places, collects a flat fee, which it then divvies up among its members. The shares are determined by a statistical algorithm. The Copyright Clearance Center uses a similar system for photocopying-a flat fee based on an initial period of statistical monitoring.

Site licenses.

An organization can pay for all of its members to have preferred access to some particular kinds of content. University site licenses to JSTOR content, Elsevier content, or Microsoft software are examples. This is particularly relevant when there are strong network effects from adopting a common standard, such as in the Microsoft example.

Media tax.

This a tax on some physical good that is complementary to the information product (i.e., audio tape, video tape, CDs, TVs, hard drives, etc.) The proceeds from this tax are used to compensate producers of content. For example, the Audio Home Recording Act of 1992 imposes a media tax of 3 percent of the tape price. [[http://www.brouhaha.com/~eric/bad_laws/dat_tax.html]

Ransom.

Allow potential readers to bid for content. If the sum of the bids is sufficiently high, the information content is provided. Various mechanisms for provision of public goods could be used, such as the celebrated Vickrey-Clarke-Groves mechanism. This could be used in conjunction with the subscription model. For example, Stephen King offered installments of his book *The Plant* on his web site. At one point he indicated he would continue positing installments if the number of payments received divided by the number of downloads from his site exceeded 75.6 percent. His experiment did not succeed, perhaps due to the poorly chosen incentive scheme. [http://www.writingonyourpalm.net/column001023.htm]

Pure public provision.

Artists and other creators of intellectual property are paid by the state, financed out of general revenues. This is not so different from public universities where research and publication is considered integral to the job.

Prizes, awards and commissions.

Wealthy individuals, businesses or countries could commission works. The patronage system achieved some notable results in Europe for several centuries. The National Science Foundation or the National Endowment for the Humanities are examples of modern day state agencies that fund creative works using prize-like systems.

All of these business models have their problems, of course, and none is likely to yield any sort of social optimum. On the other hand, it should be kept in mind that copyright is a second-best solution to intellectual property provision as well.

Perhaps the ultimate saving grace is that the same technological advances that are making digital content inexpensive to copy are also helping to reduce the fixed cost of content creation. Hundreds of thousands of people are giving away digital content, from blogs to garage video to open source software. The increased availability of content due the reduction in the cost of creating and distributing it will presumably increase competition

and reduce the price consumers pay for legitimate access to content. This trend may serve to counterbalance some of the forces that have lend for increased copyright protection.

It is highly unlikely that free content alone will meet all of our needs for content. However, it may be that free content, some combination of the business models described above, and traditional copyright will do an adequate job of satisfying our demand for information goods.

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Footnotes:

[1]Space precludes references to all deserving works, but National Academy of Sciences [2000], Maxwell [2004], and Musick [2004] offer discussion of some of the unique challenges associated with digital media.

[2]The discussion of international copyright that follows draws on Clark [1960], Varian [2001], and Warner [1999]. See also Kahn and Sokoloff [2001].

[3]Several reviewers have questioned this claim, believing it to be too extreme. However, it is from a highly authoritative source (Hart [1950], p. 103). The explanation for the large disparity in price is probably that the American edition was published in pamphlet or newspaper form, while the English edition was a bound book. Hart [1950] also notes that in 1842, when Dickens first visited American, he found that his published works were available in pamphlet form for twenty-five cents each or five dollars for the entire set.

[4]The Business Software alliance estimates that the PC software industry is about $50 billion in retail sales worldwide, with 36% of PC software being pirated. Of course, it is notoriously difficult to estimate the magnitude of illicit activities.

[5]The seller could also sell a bundle of two copies of the CD for $29, but the same point applies.

[6]See Novos and Waldman [1984] and Besen and Kirby [1989].

[7]One could also imagine a model where the transactions costs of sharing was negative. For example, a library might have lower total storage costs than the sum of the storage costs of a group of individuals. In this case, sharing is the more efficient technology.

[8]We assume that the library also has some way to restrict access to legitimate users, so there is no free rider problem. Scotchmer [2005] and Geng et al. [2003] offer differing critiques of what I call the "library model."

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