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THE PAST AND THE FUTURE OF THE ECONOMICS OF COPYRIGHT

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Abstract. The economics of copyright as such has certainly come of age. About 70 years has passed since the very first time that economists gave serious thought to the copyright system, although it has been only during the last 20 years that the literature has flourished. In this paper an overview of the general topic of the economics of copyright is given, and the areas that have already be touched upon are discussed. Then, a speculative answer is attempted to the question of what the near future will hold.

1. Introduction

At the heart of any economic transaction lies the basic motivating factor of differences in the wants and needs of the participants. In turn, differences in wants and needs are generated by the non-homogeneity of basic endowed personal aspects such as innate abilities, risk aversion, time constraints, and general personality traits. The end result of these differences is that supply and demand for diverse goods and services meet in an organised market environment where mutually beneficial trade can take place.

However, in order for any market to function properly, certain fundamental prerequisite characteristics are required of the subject matter of the transactions. In particular, we should always require that the subject matter

1. be clearly identified and defined, and
2. in some naturally defined and logical manner, initially "belongs" to the seller, and after the transaction will, in the same way, "belong" to the purchaser.

Thus not only must we have a consensus as to exactly *what* is being traded, but we must also have a clear notion of *ownership*, without which the very right to sell should be heavily questioned. Thus, any legal system that is designed such that groups of individuals can live together in peace, harmony and prosperity, must necessarily contemplate the question of ownership of valuable assets.[1]

Together with ownership comes the natural right of possession and use, and ultimately utility or personal satisfaction (whether or not the generation of utility implies that the valuable assets are used up in some sense). However, in general it is possession rather than ownership that enables use and hence utility gains, and so without a complete and satisfactory definition of ownership, and a socially accepted

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[1]For the purposes of economic analysis, a "valuable" asset can be simply defined as any element that can be clearly defined and characterised, and that generates positive marginal utility to at least one member of society.

means of protection of the right of ownership, social chaos would ensue as individuals plunder each other with the objective of enhancing their own possession and use over and above that of others. Only when ownership has been fully characterised and defined in a socially acceptable manner can valuable goods be subject to legitimate market transactions, leading ultimately to the socially desirable situation of the goods in question being owned by those who most value them.

For some assets, definition and characterisation is a relatively simple, and uncontroversial, matter – a car, a particular well defined area of land, etc.. The ease of characterisation of such assets results from them being present in a natural tangible form. Similarly, it is a simple matter to establish ownership of such assets, and to protect the right of ownership, and thereby to establish markets in which they can be transacted. However, there are other valuable assets that are not so easy to define and to characterise. Typically, products of the mind and of human intellect in general, come into this second category. Ideas and the expression of them are certainly valuable assets in the utility enhancing sense, but they are hardly present in tangible forms, and so they become so much easier to plunder, and correspondingly more costly and difficult to protect,[2] particularly with recent advances in digital technology. It is, therefore, natural that the law establishes a basic difference between intellectual property and other more tangible types of property, when the question of ownership is under discussion.[3]

It is the ease with which intellectual products can be copied that makes them particularly special when issues of ownership are considered. To an economist, "ease of copying" is tantamount to "costly protection" from copying. One of the popular arguments against private ownership of intellectual products (that is, arguments in favour of fair use) is that the transactions costs that are created by attempting to protect such easily copied goods may well outweigh the social benefits that they provide (see Gordon, 1982). In any case, ownership of these goods certainly needs to be clearly established, as well as the particular rights that the owner has over the intellectual products, in order that there be both an incentive for them to be created in the first place, and, once created, for them to become more easily subject to market transactions. Quite generally, a difference has been established between two types of intellectual products, "ideas" themselves on the one hand, and the "expression of ideas" on the other. The first is the subject of patent law, and the second of copyright law. Here, we shall only be concerned with copyrightable creations.

For the purposes of this very general overview, we can simply define copyrightable creations as any type of non-randomly generated ordered string of symbols (e.g.

[2]This is quite apart from the public good nature of intellectual products, a characteristic that is shared by only a limited set of other types of property.

[3]And indeed it seems that intellectual property is outpacing tangiable property as a fundamental base of modern economies – "In recent decades, for example, the fraction of the total output of our economy that is essentially conceptual rather than physical has been rising...Over the past half century, the increase in the value of raw materials has accounted for only a fraction of the overall growth of U.S. gross domestic product. The rest of that growth reflects the embodiment of ideas in products and services that consumers value. This shift of emphasis from physical materials to ideas as the core of value creation appears to have accelerated in recent decades." (excerpt from Alan Greenspan's speach inaugurating the 2003 Financial Markets Conference of the Federal Reserve Bank of Atlanta, text available online at www.federalreserve.gov/BoardDocs/speeches/2003/20030404/default.htm).

words and/or numbers), patterns, and designs. In short, any form of original expression is a copyrightable item. In particular, copyrightable creations can very often be captured entirely in a digital format, making their storage and retrieval (and, of course, their reproduction) a rather simple and low cost activity. Thus, the cost of policing copying is high, which makes copyrightable creations particularly succeptable to such activity. Copyrightable creations also have the general attribute that their basic reason for existence is for enhancing consumer welfare directly – that is, they are often created with the sole objective of being made available to the consuming public.[4] Hence a particularly interesting problem arises; many copyrightable creations only exist to be somehow traded, but the very high cost of policing copying tends to severely limit their marketability. Exactly how (indeed, if) we can best get around this problem is, perhaps, one of the fundamental challenges facing the economics of copyright today.

In this paper, a very simple overview of the basic economic fundamentals of copyright is given. The objective is to touch upon most of the areas that have been shown to be important, without going too deeply into any of them. The paper is *not* a survey article, although without doubt a survey article of the relevant literature would be most welcome and useful. Once the basic areas of the economics of copyright that have appeared in the literature over the past decades have been explored, the final section of this paper then goes on to suggest where economic theory might profitably turn its attention in the near future.

2. The recent past, or where has the economics of copyright been?

The "economics of copyright" is often said to have been founded in 1934 by Arnold Plant (see Plant, 1934), although many relevant discussions appear as far back as in the writings of Adam Smith (see, for example, the account in Gordon, 2003). However, Plant appears to have been the first to soundly consider the economic trade-offs generated by the grant of copyright. Since then, we have come a long way – and a good many challenges to the business of creating and distributing copyrightable produces have been feared, discussed, analysed and some have been overcome (e.g. radio broadcasts of music in the 1920's, photocopying in the 1960's, analogue taping in the 1970's, VCR taping of movies in the 1980's, digital CD burning in the 1990's, and now digital DVD burning and on-line file sharing). Along the way, a great many of the tools of economic theory have been used (to mention a very few, the Coase Theorem, price discrimination, the theory of regulation, and the theory of optimal behaviour in general).

2.1. **Some special economic features to take into account.**

When studying the economics of copyright and of copyrightable creations, it is well to bear in mind the very special environment that surrounds such products. There are several important aspects of the very nature of copyrightable creations that sets them aside from tangible property right from the start, and economists have always taken special care to bring such aspects to the forefront of their analyses. Some of the most prevalent of these features and characteristics are the following[5]

1. Copyrightable creations are "public goods". In the sense that the addition of consumers does not affect the amount or quality available for consumption by

[4]Note that the same is not necessarily true for patentable creations, that may be held secret by the innovating firm in order to gain a market advantage over competitors.

[5]These features are discussed at greater length in Watt (2000).

others, as well as the fact that it is very costly to identify (and then exclude) non-payers, copyrightable creations fulfil the basic requisites to be classified as public goods.

2. What is "transacted" is the right to *access* the intellectual property concerned, not the property itself. Furthermore, the right to access can be (and typically is) heavily sub-divided according to type and degree of access (e.g. the right to mechanical fixation, the right to public performance, the right to broadcast, the right to translate, the right to adapt, etc.). In the sense that what one gains under a copyright transaction is the use (in a certain sense, possession) for certain purposes or for a particular length of time, without ever gaining ownership, such transactions are quite similar in nature to rental contracts.
3. There is an important difference between the intellectual property that is to be accessed and the "delivery good" via which it is made accessible. Without some means of consumption, a copyrighted creation can never be consumed in any way, so we find that we require a second good, upon which the copyrighted creation can be affixed, that then allows it to be accessed. Examples of delivery goods are the CD Roms that allow songs to be played, books that allow a story to be read, and concerts that allow music to be heard. Typically, delivery goods themselves are private rather than public (it is easy to exclude free-riders, and the addition of consumers does affect the rest), they are susceptable to wear-and-tear (although the creation itself is not), and they can be legally traded downstream.
4. We must be careful to distinguish between what we mean by a "copy" of a delivery good, as compares an "original". No-one can argue against the fact that when you purchase a CD Rom from a record store, what you get is a copy from some master version in the possession of the record label. However, this terminology can then become confusing as we would like to distinguish between such a legally purchased item and one that is produced by illegally copying that one purchased in a retail outlet. The norm that is often used in the literature on copying is to refer to an "original" as any use (e.g. fixation onto a physical support) made of the intellectual property for which the copyright owner's permission has been granted (normally via a royalty payment), and a "copy" as any use made for which the owner's permission was legally required but was not given. This norm will be followed here.
5. The production technologies of copyrightable creations are very special – they typically display a very high fixed cost (of creation) and a very low marginal cost (of reproduction). Indeed, the marginal cost may be very close to 0 in many instances. This type of production function leads directly to several important points. Firstly, the more competitive is the market in which access to the creation is organised, then the closer we can expect that the price will drop towards marginal cost, making it unlikely that the transaction generates sufficient revenues to cover the fixed cost of creation.[6] If this is so, then unless some sort of restriction on competition is allowed, it is unlikely that the creation will be created in the first place. Secondly, the very low marginal cost of reproduction makes infringement of a copyright that is accessed at a price significantly above marginal cost very profitable (and most likely costly

[6]Whether or not enough revenue is generated depends, amongst other things, upon the price elasticity of demand.

to police). Thirdly, digitalisation allows a very low cost of reproduction, also implying a very low cost of distribution (on-line), which in turn implies that entirely new business methods are being introduced as rapidly as the internet develops.

6. Copyright administration is set in an extremely rapidly changing environment. Aside from basic preoccupations that the introduction of radio broadcasts would affect the sale of records in the 1920's, up to about 40 years ago there was really no important perceived problem in copyright administration.[7] Then, during the decade of the 1960's things began in earnest when the widespread introduction of photocopying challenged the way copyright in the written word was handled. About 30 years ago, the scene changed to the arena of pre-recorded music when analogue taping of LP records became the big issue. Then about ten years later, the VHS recording technique was introduced, and again many major issues regarding copyright arose, this time in connection with television broadcasts of movies, and the ability to skip the adds that paid for the emissions. Things really started to heat up when, only about 10 years ago, the technology for reproducing almost perfect copies of musical CD Roms, in only a very few minutes, became standard issue in home computers the world over. Today, while the problem of CD burning has not ebbed away (in fact it has been extended to DVD technology), the most pressing issue appears to be on-line file sharing (via Napster-type mechanisms), which copyright holders are claiming is eating so significantly into profits that the very continuity of the business of publishing and distributing music is threatened.
7. The efficient administration of copyright is fraught with high transactions costs, and the existence of externalities. Attempting to correct for one externality normally only gives rise either to a new externality (faced by another party), or to further transactions costs.

In short, as the reader can easily see from the above, the study of efficient utilisation of copyright must be cast in a particularly complicated, and somewhat special, environment. Above all, the way copyright should be handled has been shown to be very dependent upon technological developments, since many copyrightable products are produced, stored, retrieved and consumed directly in a digital environment. This, of course, renders copyright administration an extremely lively stage for analysis, with new issues replacing older ones at a rampant pace.

2.2. **Copyright's dilemmas and trade-offs.** Economists are intrigued by trade-offs. The constant give-and-take that characterises almost any economic problem is precisely what leads to a natural definition of equilibrium – when the next "give" effect is exactly countered by an opposite "take". Copyright can be exemplified by several trade-offs, which we can correctly regard as being dilemmas when, for a real-world situation, the exact location of the equilibrium (indeed if it exists) is unknown and perhaps even unknowable with any certainty.

[7]The problems discussed by the early authors generally amount to details about exactly how much copyright protection is required (see Plant,1934, Hurt and Schuchman, 1966, and Breyer, 1970). Given that at that time the principal form of copyrightable intellectual property that they were interested in was the written word in printed format (which has many market based means of self-protection), it is little wonder that they generally argue for softer external legal protection.

Certainly the most well known, and most discussed, trade-off in the copyright literature is the attempt to balance the incentives of creators against the consuming public's utility – a trade-off between efficient production and efficient consumption exists. As was pointed out above, the very low marginal cost of reproduction of copyrightable property means that in a competitive market it would likely not exist (since a price close to marginal cost may not generate sufficient revenues to cover the fixed costs of creation). Thus the argument is that the incentive to create must be fostered by the introduction of market power in the form of a monopoly over how the creation is to be used. However, this has the well known effect of restricting total access to a set of consumers that excludes users who are willing to pay a price strictly above the marginal cost of supplying them. The well known monopoly deadweight loss ensues.

Perhaps one of the best known statements of this dilemma is that given by Landes and Posner (1989); "Copyright protection – the right of the copyright's owner to prevent others from making copies – trades off the costs of limiting access to a work against the benefits of providing incentives to create the work in the first place. Striking the correct balance between access and incentives is the central problem in copyright law."

Thus, copyright is designed to provide a means under which final users can contribute to the costs of creation, via royalty payments to the creator, in exchange for the creator to expend efforts in creating and disclosing the creation publicly.

However, a dilemma is clearly present, since neither the costs of limiting access, nor the benefits of providing incentives can be reliably measured. To measure these effects properly requires at least an accurate equation for the market demand for the creation in question, however we would require this equation to be known *before the creation itself even exists*. Even if this problem can somehow be surmounted, we are still faced with the asymmetric information problem regarding the personal utility characteristics of the creator, since this information is necessary if we are to correctly assess the minimal incentive that is required for creative effort to be expended. Finally, of course, the rapidly changing technological environment implies that a static equilibrium can never be hoped for, and so a static legal mechanism can only ever be adequate transitorily.[8]

The second trade-off that must be addressed by copyright law is the balance between the static and dynamic effects that emerge when the cumulative aspect of creation is taken into account. We need enough protection so that, at any given moment of time the correct amount of creation is undertaken by the correct individuals, but not so much protection that second-generation creation is thwarted. Currently, copyright is granted for the life of the author plus 70 years. This makes it very costly to locate the rights owners to an old book if one plans to edit a re-print. While for book re-prints this may be a rather infrequent happening, it is more likely that old songs will be remade (e.g. recently Rod Stewart published an album of songs originally written in the 1920s), and that old films will be remade, or that new films will be made of old books (e.g. Batman, Pinocchio, and Tarzan,

[8]In fact, even transitorily, copyright law can only ever be an approximation to an "optimal" solution. As individual creators differ, so will their individual perceptions of what is or is not adequate in terms of copyright law. But, only a single copyright standard can be applied to all, or else enormous transactions costs will ensue. Thus there is an aggregation problem that naturally implies that certain inefficiencies cannot be avoided.

to name a few). Searching out and paying copyright holders can sometimes be an expensive business.

Thirdly, there are several dimensions along which copyright protection can be defined, and the "optimal" mix of these options, even for an agreed total effect, is an open question.[9] Copyright can be defined according to

1. duration; the length of time for which the legal copyright is enforced,
2. depth; the particular aspects of the creation that are protected (and those that are not), and
3. breadth; what particular acts are deemed to be copyright infringing (and what are not).[10]

Right now, in most developed countries, duration is for the life of the author plus 70 years. As far as depth is concerned, only expression (and never ideas expressed) is protected, word strings are protected, as is music and other ordered strings of symbols (e.g. software), but algorithms are expressly not protected. Copyright breadth is limited mainly by "fair use" (which includes certain academic uses for teaching and research, and home recording of musical compositions), and independent creation.

The reason why the particular mix of protection dimensions causes a dilemma is, once again because of the impossibility of gathering the information required to answer the question definitively, but also because there may well be a very fine line between the relative optimality of different options. Consider the following over-simplified example. Let us assume that if a creator is given (under copyright protection) the incentive to create, then a product comes into existence for which the aggregate demand in each subsequent period of time is $p = m - Bx$ (where x is the total amount of access given, and all variables and parameters are defined positive).[11] Copyright law defines both the time horizon over which protection is to be enforced, t, and the breadth of protection, b, such that for each period during which the copyright is valid, the creator has a monopoly for granting access to a demand curve of $p = m - bx$. Clearly, the copyright authority must set $b \geq B$. Assume that there are no policing or other transactions costs, that the marginal cost of production of x is 0, and that the fixed cost of creation is $K > 0$. We also assume that all economic agents are risk neutral, and have a common time discount factor, λ. The regulator's problem is to define (t, b) in such a way that social welfare is maximised.

The choice of b sub-divides the area under the aggregate demand curve $p = m - Bx$ into four regions – the creator's profit, $\pi(b)$, consumer surplus in the creator's market, $C(b)$, deadweight loss in the creator's market, $D(b)$, and total welfare in the unprotected market, $W(b)$. However, the sum of the four regions is independent of b

$$S \equiv \pi(b) + C(b) + D(b) + W(b)$$

The four regions are shown in figure 1.

[9]For the closely related case of patents, the optimal mix of protection dimensions is the subject of Nordhaus (1969), Tandon (1982), Gilbert and Shapiro (1990) and Klemperer (1990).

[10]Depth and breadth are often bundled together under the title of "copyright scope".

[11]Assuming that each consumer would like one unit of access, this demand curve can be thought of as the ordered list of consumers according to willingness to pay when there is a continuum of consumers.

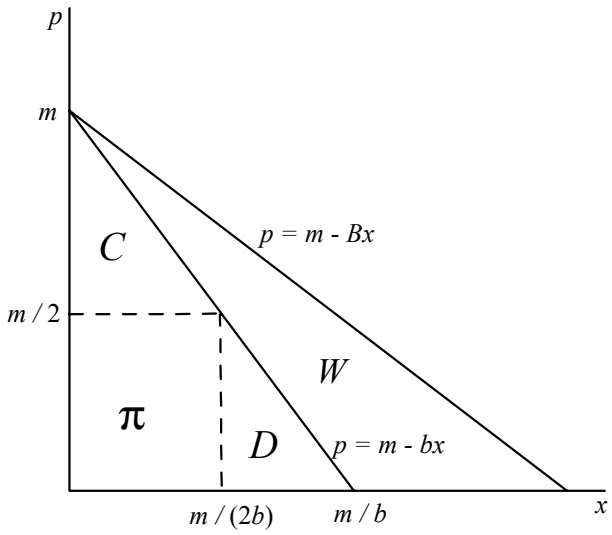

FIGURE 1

Note that, due to having linear demand, it turns out that the deadweight loss is equal to exactly one half of the profits in each period; $D(b) = \frac{1}{2}\pi(b)$. Now, total social welfare per period over the time horizon for which the copyright is enforced is $S - D(b)$, which is equal to $S - \frac{1}{2}\pi(b)$, and social welfare per period from then on is just equal to S (since access to the creation then falls into the public domain). Thus the regulator's problem is

$$\max_{t,b} \sum_{i=1}^{t} \lambda^{i-1} \left(S - \frac{1}{2}\pi(b) \right) + \sum_{i=t+1}^{\infty} \lambda^{i-1} S$$

subject to

$$\sum_{i=1}^{t} \lambda^{i-1} \pi(b) \geq K$$

However, the objective function can clearly be written as

$$\sum_{i=1}^{t} \lambda^{i-1} \left(S - \frac{1}{2}\pi(b) \right) + \sum_{i=t+1}^{\infty} \lambda^{i-1} S = \sum_{i=1}^{\infty} \lambda^{i-1} S - \frac{1}{2} \sum_{i=1}^{t} \lambda^{i-1} \pi(b)$$

the first term of which is independent of both t and b. Thus, the problem is simply

$$\min_{t,b} \frac{1}{2} \sum_{i=1}^{t} \lambda^{i-1} \pi(b)$$

subject to

$$\sum_{i=1}^{t} \lambda^{i-1} \pi(b) \geq K$$

That is, we want to minimise the deadweight loss subject to the author still receiving sufficient compensation for him to participate. This problem is clearly solved for *any* (t, b) such that the constraint saturates – that is, there is no unique solution.

Naturally, things are different as soon as we introduce asymmetries (perhaps we could make the creator more risk averse than society, or more impatient, or we could introduce some sort of social cost structure to the two dimensions of protection) that would lead to a particular solution emerging, but the moral of the example is that there may well be a very thin gap between what is optimal and what is not, which leads to a natural dilemma when one particular solution must be implemented.

Last, but certainly not least, as far as copyright's dilemmas are concerned, is the constant conflict that arises between copyright (actually, intellectual property law in general) and anti-trust law. In some cases, it is almost as if copyright confers monopoly power, only to have anti-trust take it away again. The dilemma is served, and now requires fine-tuning two different, all-be-it closely related, bodies of law.

Indeed, the intersection between copyright and anti-trust is very much a current hot potato debate topic (above all, the Microsoft case). However, it is well to bear two important points in mind when we do consider the relationship between copyright and anti-trust. They are;

1. The "monopoly" created by copyright is not like most economic monopolies, it is really nothing more than the protection of private property from misuse. Hence, it is only a "monopoly" in the same sense that we can exclude entrance to our homes to whoever we wish, and we can refuse to transport unknown people in our automobiles.[12]
2. The copyright "monopoly" is associated with a deadweight loss to be sure, but it also is directly responsible for the generation of consumer surplus and profits.[13] Thus, in a sense the deadweight loss is productive, since eliminating it would, in principle, entail elimination of positive social welfare in the form of consumer surplus and profits.

These four dilemmas, or trade-offs, are at the very heart of the economics of copyright. Only time will tell if any genuine and lasting light can be shed on the path that leads to an equilibrium, or indeed if all such paths lead to dead-ends, that is perhaps no single general equilibrium situation that simultaneously balances each of the trade-offs exists.

2.3. **The economics of copying.** If there is one single area of the economics of copyright that has received repeated attempts at formal modelling, it is certainly the question of copying (see, for example, the papers by Liebowitz 1981, Johnson, 1985, Liebowitz, 1985, Novos and Waldman, 1987, Besen and Kirby, 1989, and more recently, Belleflamme, 2003). Models have been developed that analyse copying from all possible angles, and that (not surprisingly) come up with ambiguous results.[14] As a general rule, almost all models of copying tend to agree on several points, in particular that copying has both positive and negative effects on social welfare.

[12]On this point, see Kitch (2000), and Liebowitz (2002).

[13]On this point, see Liebowitz and Margolis (2003).

[14]I think that it is fair to say that the final results that are generated have a stronger than usual dependence on the assumptions that are used at the outset.

The underlying problem in copying models is the existence of close substitutes (possibly perfect substitutes) that compete with originals in the market. In this sense, copying is formally very similar in nature to models of smuggling, sharing, and recycling and second hand goods, each of which has been studied in the literature (see Bhagwati and Hansen, 1973, Liebowitz, 1982, Varian, 2000, and Swan, 1980). Almost all copying models also tend to study the alternatives available to the owner of the good being copied, outside of whatever formal laws against copying that may exist. Thus the producer of originals will not typically want to eliminate all copying, since doing so may be prohibitively expensive in terms of resources spent in protecting the market position of his own products.

The empirical measurement of the effects of copying have also come very much to the forefront lately, with the outcries of the record industry concerning the losses due to on-line access and CD burning (see for example, IFPI report on piracy, 2003). While this issue has been mentioned in the theoretical literature, the types of numbers that have been bandied about recently are clear evidence that scant attention has been paid to the economist's word. Basically, the lobby group technique consists in making a rough estimate of the number of copies circulating, say n (this estimate can be produced by counting blank supports sold, by tracking the sales of copy technologies, by counting on-line downloads, or even by losses in projected sales[15]). Then the number of copies is multiplied by the current market price, p, to get the number that is then published as total loss to the industry, $L = pn$. On top of this loss to the recording industry, it is often stated that consumers have lost consumer surplus, workers have lost jobs, and society has lost creative products as the lost royalty income has meant that authors have defected to better employment.

This is, however, very misleading for several reasons. Firstly, even if n is a relatively accurate and unbiased estimate of the number of copies, it is not lost revenue but rather lost profits that the recording industry suffers. If is costs c to produce and distribute each recording, then the loss would be better calculated as $n(p - c)$.

Furthermore, it is certainly not true that all copies that circulate are lost sales. If no copying were available, those n consumers would not all purchase an original, since some of them would prefer to go without. This is a simple extrapolation from the undeniable fact that copies sell at a lower price than do originals. The situation is graphed in figure 2, where the consumer's initial wealth is $\overline{w}$, and $U(w, x)$ is the utility obtained from wealth w and x units of the good in question.

Clearly, so long as $p_c < p^* < p_o$, where p_c is the price of a copy, and p_o is the price of an original, then this person would copy if he could and not consume if he couldn't.

Reliable estimates of the proportion of copies that are in fact lost sales are very difficult to come by, but most relevant studies suggest that the figure is between about 25 and 40% (see, for example, Mannering, 1994, and Warner Communications Inc., 1982).[16] If we take as a rough benchmark a figure of about a third, then the

[15]Naturally, loss of projected sales is a particularly weak indicator of the scope of copying. Many economic factors aside from copying can contribute to sales fall-offs – for example, the huge increase in the use of mobile telephony by young people has obviously displaced other goods (including pre-recorded music) from the bundle of goods purchased. As an example, Widdows and McHugh (1984) estimate that, contrary to the claims of the recording industry, up to 85% of a downfall in sales of pre-recorded music in the late 1970s was due to factors other than copying.

[16]Clearly, the proportion is greater the greater is the difference between the prices of originals and copies. For the case of online downloads through file sharing, the price of a copy is for all

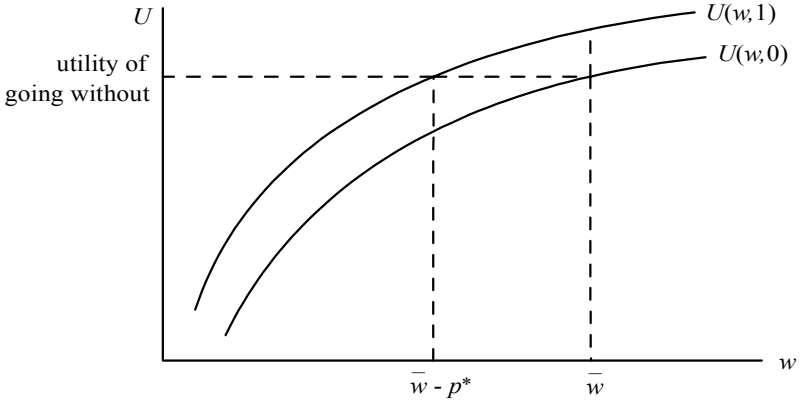

FIGURE 2

true economic loss to the recording industry of the existence of n copies is only $L = \frac{n(p-c)}{3}$. Now, it must be emphasised that I am in no way condoning the illegal behaviour of copyright infringers (whatever is the loss to the recording industry, it is certainly positive and therefore it is greater than it should be), however it would certainly help both guidance of efficient public economic policy, and the public image of the lobby groups, if an economically meaningful figure were given in the first place.

Thirdly, it is not valid to assume that in the absence of copying the price of originals will not change. Clearly, if originals would be priced differently in the absence of copying, so would the number of legitimate sales change, as would both profits and consumer surplus. Indeed, the most likely scenario is that, should all copying suddenly be eliminated, the additional monopoly power then enjoyed by the seller of originals will lead to a greater price, lower legitimate sales, and a net gain in profits at the expense of consumer surplus and overall social welfare.

Fourthly, it is certainly not true that lost sales to copies represent in any way lost consumer surplus. Indeed the opposite is clearly true – since copies allow consumers to enjoy the benefits of consumption at lower prices, consumer surplus is greater under a copying scenario than when copying can be eliminated.

Fifthly, jobs are also not necessarily lost – they simply change hands. If it is the case that copies are produced in third world countries, and if the lost jobs are in the first world, then what is surely likely is that the total wage bill drops, although it becomes likely that more actual individuals become employed the world over. Indeed, the ability to copy is known to provide significant short-term benefits to third world countries, thereby aiding development to a certain extent,[17] which may be why many such countries either did not have or did not enforce copyright until relatively recently.

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intensive purposes 0, and so the proportion could be quite low. For example, Liebowitz (2003) estimates that only 20% of MP3 downloading substitute record sales.

[17]The benefit is short-term, since copying is a very inexpensive manner in which valuable technologies and cultural richness can be installed locally. However, the effect backfires in the longer term, as it stifles local incentives to embark upon home-grown technological development. For more details, see (for example) Grossman and Helpman (1991).

Finally, the effect of copying on creation is extremely hard to ascertain with any degree of precision. In any case, it is certainly simple to formulate arguments to the effect that copying may not have such a great effect on the quantity or quality of creations produced. Here are three that spring to mind;

1. If copying were to affect all creators proportionally in the same way, then the first to go would be the least popular anyway – those marginal artists whose value outside of music is very close to their value as musicians. The social loss would be minimal in this case.
2. Copying is a wonderful free advertisement for up-and-coming artists. Thus the ability to copy may actually stimulate creativity by new comers, since the costs of distribution become so much cheaper.
3. The most likely scenario is that the hardest hit artists by copying are those with super-star status and incomes. However, these individuals should have very low marginal utility of money, and so the effect of lost dollars on their behaviour should be minimal.

In any case, almost all analyses of copying (there are a few exceptions) are set in models in which no specific laws against copying exist, and so the situation is a game in which the copyright holder must protect his creation from copyists using behavioural based strategies. We now go on to consider the intersection between such strategies and formal copyright law.

2.4. **Copyright law and alternatives.** Copying, as in the previous section, is often modelled as a game in which there is no sentiment of illegality surrounding the act of copying itself. Also, copying is modelled quite independently from the moral considerations of the legally defined property rights in the creation being copied. To make a clear analogy, it may be socially beneficial for Bill Gates to give all of his money away to poor families in Africa, and if law that demanded he do so were put to vote, surely it would be a brave man who would bet against it being an almost unanimous winner. However, such a motion will never come to vote, and indeed, will never even be seriously considered as economic policy, simply because it makes a mockery of the legal system as we know it. Thus all the formal mathematical results in the world to the effect that rampant copying of copyrighted property is social welfare enhancing are irrelevant in a world in which we still believe in something akin to Lockean property theory – whatever we manage to create using only our own work, effort and skills, becomes by natural right our own personal property.

Now, on the other hand, the fact that copyright law formally defines a copyrightable product to belong to the creator (at least initially, that is, until the creator passes the right on in a legal transaction, or until it naturally expires) is quite a different kettle of fish to spending huge amounts of public resources to protect that property right. Society's administrators may never take steps towards taking intellectual property that belongs to its citizens, but one wonders why many citizens seem to accept that society should blithely spend whatever resources are required to protect the property right from third-party misuse. The courts are not the guardians of private property, but rather they are the guardians of the law. That is, it is one thing for the system to adequately punish offenders if they are caught, but it is quite another for it to spend resources searching offenders out! Society should spend the socially optimal amount of resources on protecting the laws that it makes. The fact that copyrightable products are, compared to other types

of property, so much more costly to protect relative to their social value, means that the marginal dollar spent protecting such creations is all the less valuable (in relative social terms). Thus, in a system in which the government equated the marginal benefit of protection of all types of property, copyright would in general most likely qualify for less state protection than other types of property.

This is a particularly important point as far as any economic analysis of copyright law is concerned, simply because there do exist alternative protection mechanisms, based fundamentally on incentives and behavioural considerations, that copyright holders can use to reduce (or even eliminate) copying, should that be in their best interests (see, for example, Conner and Rumelt, 1991). The economic literature that considers such strategic options is now quite vast, but surely the most important of all of the strategies that have been suggested is the use of strategic pricing (for example, Nascimiento and Vanhonacker, 1988, Watt, 2000, and Belleflamme, 2003).

Clearly, the lower originals are priced, the less likely it is that copying will happen. This is simply because an original can never provide for less utility than a copy, so at the same (or lower) price, originals will be preferred by all consumers. Exactly how low originals can be priced without incurring in negative profits for the copyright holder depends entirely upon the price elasticity of demand for originals, and the substitutability between originals and copies. In any case, the jist of almost all papers on the economics of strategic pricing under copying is that there exists a price that can be charged by the copyright holder that will eliminate all copying, but that price may not provide for the same or greater profit than charging the optimal price in a market in which copying exists (that is, sharing the market with copyists).

A second example of a strategy that contributes to the reduction of the amount of copying that occurs is bundling; selling an easily copiable good together with a non-copiable one. For example, many new computers come with pre-installed software (Windows, MS Office, etc.), or the case of operating manuals being sold together with the relevant apparatus. Bundling clearly reduces the incentive for consumers to copy, thus destroying much of the copying market. Bundling of novels or music CDs with an autograph of the author (singer) is another example of an attempt to differentiate the original product from the copied one sufficiently for the copy market to be severely negatively affected.

Thirdly, we have lead time and stock-piling. Clearly, no copying at all can ever take place until the very first original is sold. There exists a certain lead time, from the very moment that originals are put on the market until the first copied versions appear, during which the seller of originals holds a total monopoly. Exactly how the demand for the product in question responds to this is hard to tell, and will again depend upon the degree of faith that consumers have in the subsequent quality of copies, in the amount of time that will have to go by before copies will appear, and the time discount factor of consumers. In any case, it is not difficult to think of examples of strong advertising campaigns that announce the exact place and date of first sale in order to capture as much of the market as possible (e.g. Harry Potter books). The benefits of lead time are often accentuated by stockpiling as an entry deterrent for copyists – the seller of originals commits to flooding the market from

his stock pile at the first sign of copies on the market, in order that the market price would go to marginal copy cost, and thus making copying unprofitable.[18]

Finally, recently a new strategy, relevant for digital environments, designed to reduce copying by increasing the cost of copying is Digital rights management (DRM). The fact that digitalisation has been so important to many copyrighted products for which creation, storage, access, and consumption have been greatly enhanced by digital formats, has lead to hidden code being installed on the access delivery good that eliminates the ability to copy (or at least, that increases the cost of copying greatly). DRM was a common strategy when zoning of DVD videos was in use only a year or so ago (it was impossible to play, let alone copy, a DVD that was purchased in one part of the world, in another). Copy-proof CD Roms are also in use today, making it impossible to copy the content of a musical CD using traditional copy technologies. However, we should note that DRM simply leads to an unproductive technology race that dedicates valuable resources to breaking codes, and to re-inventing new codes. DRM may also violate certain private rights, as for example is the case of copy-proof CD Roms, since there exists the right of private copy in almost all countries.

On the other hand, the economics literature has considered in great detail a second set of strategies that, while they do not contribute to the elimination of copying, turn copying to the advantage of the copyright holder. The first, and certainly most well known, of these strategies is known as "indirect appropriability", and was introduced by Stan Liebowitz (see Liebowitz, 1985). Indirect appropriability is simply price discrimination – if the copyright holder can clearly identify the units of delivery good that will be used as models for copying, then the purchaser of these units will have a higher willingness to pay than other purchasers. Thus, price discrimination can be used to appropriate all the downstream profits that are then earned in the copying market. The example most cited for indirect appropriation is the case of library subscriptions to academic journals, which ever since photocopying became sufficiently available, have been priced well above individual subscriptions (on the grounds that library copies will be far more heavily photocopied).

Other strategies that contribute to making copying profitable for the copyright holder are:

1. Network effects (see, for example, Takeyama, 1994). If the demand for originals is increasing in the user base, and if copying increases the user base, then copying has positive effects for the profits of the seller of originals. These positive externalities need to be considered (as well as the negative effects) when any analysis of the welfare effects of copying is carried out. Often cited examples of network effects that may make copying profitable for copyright holders is the case of computer software (the more users that exist, the less costly is intercommunication between users of similar software, and so the greater is the willingness to pay for originals) and singer's fan clubs (the more copying that occurs, the more popular and "trendy" the singer becomes, and so the

[18]Lead time and stockpiling were quite common for the case of book publishing several decades ago. For example, it is a principal aspect of the argument in Plant (1934). While modern day lead time for the case of musical CDs has been reduced to a matter of hours (or perhaps even less) due to digitalisation, it is strange to see that the use of stockpiling as an entry deterrence strategy is no longer seen.

greater is the willingness to pay for concert tickets and original pre-recorded formats).

2. Bundling with advertising. As mentioned above, bundling copyrighted creations with non-copiable goods can contribute to eliminating the demand for copies, but easily copiable goods are also very often bundled with advertising, in an attempt to turn copying to the favour of the copyright holder. When an advertisement cannot be eliminated from the copyrighted product, the more copying that occurs the greater is the impact of the advertising, and so the greater is the price that the copyright holder can charge to place the advertisement in the first place. Examples of this type of strategy are the recent appearance of BMW cars in James Bond films, and scroll advertising across the bottom of television screens during sports broadcasts.
3. Experience effects and versioning. When lower quality versions of copyrighted products are made available (at a low, perhaps even zero, price), it is argued that consumers gain experience in the product and that they learn at a low cost the benefits that the full product offers (Takeyama, 1997). In this way, uncertainty as to the value of purchasing the full product is reduced, and more full products can be sold (or indeed, the willingness to pay per unit is increased). For example, it is common to see newspapers and magazines publishing the opinions of critics concerning new novels, or even publishing the novel itself in installments. We also see "student" versions of software selling well below the price of the full product (the "professional" version), radio and television stations often broadcast versions of new songs before they are actually released for purchase, and it was even argued in the Napster trials that music file sharing was a means under which music consumers could experience songs at a low cost.
4. Finally, taxes on blank supports and on copy technologies (e.g. blank CDs, and photocopy machines). Since copying requires both blank supports to act as delivery goods for the copies, and also copy technologies, in some countries the legal authorities have allowed copyright holders (or their representative groups) to directly tax consumers of blank supports and copy technologies to compensate for the use of these items in duplication of copyrighted material. However, quite clearly such taxing simply shifts the externality costs of copying from the copyright holder to legitimate users of blank supports and copy technologies (i.e. those users that do not duplicate copyrighted products). This has led to such taxes being a highly controversial issue, to the extent that they have even been declared unconstitutional in some countries.

In spite of the great number and variety of alternatives to copyright law, and options that make copying profitable, almost all legislations also have a protection mechanism built into the copyright law. Copyright law itself, then, serves two purposes – firstly it clearly defines and characterises ownership of copyrightable products, and secondly it attempts to provide some sort of artificial protection for that ownership right.[19] Basically, as a protection mechanism, copyright law can be thought of as a system under which a lottery is introduced for copies. In the same way as all penal laws, copyright law offers a certain probability of detection of

[19]For economic models of copyright law, see (for example) Novos and Waldman (1987), Landes and Posner (1989) and Koboldt (1995). For a general view of the trade-off between probability and magnitude of fines, see Polinsky and Shavell (1979).

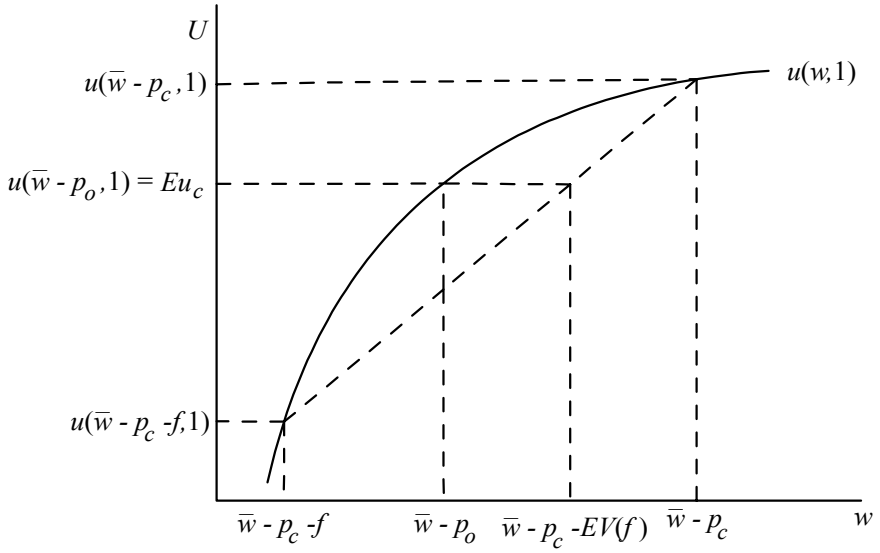

FIGURE 3

copies, and a certain penalty if detection occurs. The objective is that the expected utility that the copy lottery offers be made to be lower than the sure-thing utility offered by originals.

Graphically, if we assume that the utility of purchasing an original is not smaller than the utility of going without, $u(\overline{w} - p_o, 1) \geq u(\overline{w}, 0)$, then the limit copyright law can be seen in Figure 3. In Figure 3, the utility of purchasing a copy conditional upon not being detected is $u(\overline{w} - p_c, 1)$, while the utility of purchasing a copy and then being detected (i.e. made to pay a fine of f) is $u(\overline{w} - p_c - f, 1)$.[20] Then in the limit, to be an effective deterrent, copyright law must define a probability of detection, π, and a fine, f, such that

$$Eu_c \equiv \pi u(\overline{w} - p_c - f, 1) + (1 - \pi)u(\overline{w} - p_c, 1) \leq u(\overline{w} - p_o, 1)$$

The problem is, clearly, the limit copyright law defines a locus of points in (π, f) space, and so the defining equation throws no real light on the choice of an "optimal" law. Not only that, but clearly the effectiveness of any particular configuration will depend critically upon the personal characteristics of the consumer in question, that is, upon his initial wealth, $\overline{w}$, and his degree of risk aversion. Thus any given legal configuration will have different deterrence effects for different individuals. Notwithstanding, it is a valid question to ask exactly what can be said about an optimal copyright law, as far as protection from copying is concerned.

And the answer is not much! However, consider the following. Say we can introduce a proportional increase in either π or f. Which of these two options will be more effective in curtailing copyright infringement? In other words, which of these two options will reduce the expected utility of copying, proportionally, by more? A proportional increase in π will reduce Eu_c proportionally by the relevant

[20]Note that the assumption is that, even though detection has occurred, the good is still consumed.

elasticity;

$$\frac{\partial Eu_c}{\partial \pi}\frac{\pi}{Eu_c}$$

and the same is true of a proportional increase in the fine f. Thus the most effective policy can be found by comparing the two elasticity values. Concretely, increasing the fine is more effective if (recall that both elasticities are negative numbers)

$$\frac{\partial Eu_c}{\partial f}\frac{f}{Eu_c} < \frac{\partial Eu_c}{\partial \pi}\frac{\pi}{Eu_c}$$

However, cancelling the common term (Eu_c) and calculating the two derivatives yields

$$u'(\overline{w} - p_c - f)f > [u(\overline{w} - p_c) - u(\overline{w} - p_c - f)]$$

which is true for any strictly concave utility function. Thus proportional increases in the fine are a more effective copyright infringement curtailing device than proportional increases in the probability of detection.

If, as is highly likely, proportional increases in the amount of the fine can be brought about with less cost than proportional increases in the probability of detection,[21] then an "optimal" copyright law from a cost-benefit point of view would comprise maximum punishment and minimum enforcement (detection probability).

3. The future, or where is the economics of copyright going?

As can been seen from the previous section, the economics of copyright has covered quite a bit of ground from its outset to the present. Many aspects of economic theory have been evoked, with success, to studying the efficient utilisation of copyright. However, one wonders if economic theory is beginning to exhaust itself as a useful application tool for copyright. In my opinion, nothing could be further from the truth!

First and foremost, we must recall that copyright is set in an environment of constant change, where technological advances are forever opening doors that only decades before were unimaginable. To keep up with such a pace, both the fine tuned details of the models as well as the very tools of analysis must also be constantly refined and updated.

Secondly, although a great many main-stream theories and basic economic models have been applied to the case of copyright, several other logical candidates have yet to be touched upon, or at the very least it would be very interesting to see far more effort dedicated to them. In this short section, I would like to suggest where economists interested in studying copyright issues could profitably turn their immediate attention.

3.1. **Theorists need some good numbers to work with.** Perhaps the most pressing area in which the economics of copyright is lacking is in serious empirical studies. While some such studies do exist, many are purely statistical with no real economic content. However, if economic theory itself is to advance in this area, and if it is ever able to provide workable solutions for the real-life practitioner, we urgently require more detailed information concerning the true arena that this

[21] There is, however, clearly a limit to how high the fine can get. The introduction of draconian fining would certainly imply political and other social costs that would outweigh their efficiency benefits.

game is being played in. The results of many theoretical papers are ambiguous simply because they depend on the actual vales of a handful of critical parameters. Knowing these values, at least to a first degree of approximation, would push the theorists towards more convincing and conclusive results.

Above all, I would suggest that what is most lacking is relevant information concerning the true demand curve for copyrightable creations.[22] By this, I mean we require information on the comparative statics of the demand for originals, as all the relevant parameters change (the price of originals, the substitutability for copies, the price of copies, wealth, the prices of other copyrighted originals and copies, etc.). Without this information, any theoretical study is pure speculation, and of very limited use for practical applications.

3.2. **Uncertainty and risk need to be accounted for.** Secondly, the majority of studies in the general area of the economics of copyright that have been carried out are set in the simplistic setting of deterministic values. However, mainstream economics has long ago abandoned this idyllic setting for the realistic one of risk and/or uncertainty. It seems quite clear to me that, if any particular sector of the economy is to be chosen as being highly prone to be affected by stochastic values, surely copyright is a prime candidate.[23] The analysis of stochastic variables in models of optimal copyright law, and in industrial organisation type models of copying, would be extremely beneficial.

Above all, as many applied microeconomists have taught us over the years, once uncertainty or risk is contemplated, rational decision making becomes a rarity. This, in my opinion, should not be interpreted as a need for alterations in the underlying rational theory (expected utility), but rather in a need for greater efforts to be made in curbing irrational behaviour back towards a rational state. Thus, uncertainty and risk lead naturally to an immensely important task for economists, that of bringing about general welfare gains by giving counsel and advice, both to practitioners directly, and to consumers (perhaps indirectly).

3.3. **Games are everywhere.** Copyright interactions are, by their very nature, highly strategic. Copyright holders compete against each other as to the content of their creations, as well as marketing strategies (exactly when to launch a new record, or the price that should be charged for it). Also, the way copyright royalty contracts are negotiated clearly opens the door to the use of any one of a host of bargaining models as natural tools of analysis. The new field of digital rights management is clearly an arena that should prove fruitful for game theorists, perhaps modeled as an innovation race between copyright holders and "hackers".

In any case, the application of game theory to the economics of copyright has already begun. Indeed, the very origins of property rights themselves (see Muthoo, 2003), and of the way in which copyright law can solve a prisoner's dilemma (Gordon, 1982) can both be seen to be applications of game theoretic tools.[24]

[22]Quite a lot of empirical work has gone into analysing, in some sence, the economic value of copyright for an economy (for example, the papers in the symposium in this issue), or the economic value of specific rights under copyright law (Towse, 2001).

[23]Of of the first efforts in this direction we can cite Towse (2001), chapter 6, and Alonso and Watt (2003), both of which analyse the risk sharing arrangements between copyright holders and the distributors of their products.

[24]See also Baird et al. (1994).

3.4. **The principal-agent setting needs to be used.** Last, but certainly not least, the principal-agent setting that has become so standard for so many applied microeconomic models should also provide significant insights to the efficient utilisation of copyright. Asymmetric information abounds in all walks of economic life, and clearly the case of copyright is no exception. It is extremely simple to think of aspects of both adverse selection and moral hazard that are present in the many levels of transaction that are relevant to copyright. Thus the principal-agent model would seem to be of significant value.[25]

I would even go as far as to argue that the problem of copyright infringement (or piracy) may even be able to be satisfactorily modelled in a principal-agent framework, in which the agent (the possible pirate) takes actions (copying or not) that cannot be costlessly monitored by the principal (the copyright holder). That sounds like a fairly standard moral hazard problem, and it may admit a fairly standard solution within the principal-agent framework. The trick would be to correctly define the contractual relationship that governs the situation, in which case it would seem that the "social contract" implied by the law may not be an unavoidable ingredient.

4. Conclusions

In this paper, I have attempted to achieve two things. Firstly, I have discussed what I see as being some of the principal avenues that economists have explored as far as copyright is concerned. Naturally, what has been discussed here reflects to a certain extent my own interests, and so I would not say that the list of general themes given here is in any way exhaustive. On the other hand, I would perhaps argue that it does include all of the most important topics for the economics of copyright.

Secondly, I have given some suggestions for possible avenues that future research in this area might take. Again, the list of options reflects above all my own interests, and so other topics could be added at the will of the reader. In any case, I do assert that the list given here may be thought of as being those tools of main-stream applied microeconomic theory that should have fruitful application to the problem of the efficient utilisation of copyright, but that have to date (at least to the best of my knowledge) either been ignored or at least been somewhat scarcely used.

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