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## THE INNOVATION COSTS OF COPYRIGHT

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**Abstract.** This paper demonstrates that an IP system that improves the supply of new ideas within its realm may adversely affect other types of innovation in the same market, unless we make the strong assumption that innovations are traded efficiently. For illustration, it discusses the balance struck by copyright regarding incentives to create new copyright works as well as incentives for other types of innovation. According to a theoretical analysis, copyright arrangements that promote content creation can adversely affect humdrum innovation in markets for copyright works. An empirical example studies the relative weight of innovation benefits and innovation costs of copyright for a particular type of suppliers of copyright works – small record companies. Prompted to consider content creation and technical innovation, these firms report that the current copyright system obstructs innovation, perhaps even more so than unauthorized copying does. While these results are probably context specific, the findings demonstrate that even rights holders can experience copyright as a restriction on innovation. We conclude that unintended consequences of IP regarding innovation not covered by it require more attention in order to inform IP policy.

# THE INNOVATION COSTS OF COPYRIGHT

## I. INTRODUCTION

An economic justification of public investments in intellectual property (IP) is that without IP, the future supply of new, valuable ideas would fall below its socially desirable level. That is because important aspects of protected works have characteristics similar to those of a public good. Effective IP systems may mitigate this problem, since they endow creators with temporary exclusive rights to their original creations.

IP is organized into several areas, which tend to be discussed in isolation. For example, patent policy is usually evaluated only by its effects on technological innovation, and copyright policy is evaluated only by its effects on the creation of copyright works. An early exception is Plant's (1934) pioneering paper on the economics of copyright. Plant did not only address the effect of IP on incentives to supply protected works. He was also concerned that effective IP may lead to the wasteful neglect of alternative investments. Following Plant, this paper deals with the effect of IP on innovation, including those innovations that are not proportionally protected.

As an illustration, the discussion focuses on copyright in markets with technological opportunities – that is in a situation in which there are profitable investment opportunities regarding technological innovation. Over the last decade, copyright policy has been undergoing substantial reforms. One central aim is to adapt the copyright system to the presence of digital copying technology. The reform process has triggered a heated public debate. One criticism raised against extensive copyright protection in this context is that it inhibits desirable aspects of technological change.

This paper is concerned with the balance struck by copyright regarding incentives to create new copyright works as well as incentives for other types of innovation. It demonstrates that an IP system that improves the supply of new ideas within its realm may adversely affect other types of innovation in the same market, unless we make the strong assumption that innovations are traded efficiently.

## II. CONTENT CREATION AND HUMDRUM INNOVATION

Over time, the supply of copyright works may improve due to two types of innovation. First, new copyright works can be produced, which will be referred to as 'content creation' in the following. Second, 'humdrum innovation' concerns the development and the introduction of new ways to deliver, present and use existing copyright works.<sup>1</sup> Humdrum innovation matters because the social value of a copyright work will not only depend on its mere existence but also on the number of individuals that can use it.

Economic assessments of copyright and unauthorized copying usually focus on rights holder revenues and content creation (e.g. Johnson, 1985; Landes and Posner, 1989; Oberholzer-Gee and Strumpf, 2007; Liebowitz, 2008). Copyright protects content and not the means to deliver it. Even where humdrum innovations are protected by other types of IP, this protection will rarely be perfectly symmetrical

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<sup>1</sup> The terminology is inspired by Caves (2000), who distinguishes between 'creative inputs' and 'humdrum inputs' in the creative industries.

(Plant, 1934; Landes and Posner, 2003). There are substantial differences between various types of IP regulations, for example copyright law and patent law. What is more, content creation and humdrum innovation are not always conducted by the same organizations (e.g. Barras, 1986; Tschmuck, 2003).

Assuming efficient trading of IP rights and technologies, copyright would still affect humdrum innovation in much the same way as it affects content creation. However, the assumption that innovations would be traded efficiently is questionable for a number of reasons.<sup>2</sup>

First, transaction costs in markets of IP tend to be high (e.g. Levin et al., 1987:788; Landes and Posner, 2003:16). This includes problems with asymmetric information, uncertainty and the risk of disappropriation, which may obstruct efficient trading of information goods and technologies. Second, effective IP rights establish some degree of market power by definition, and many markets for copyright works exhibit high degrees of ownership concentration. The economic theory of bargaining suggests that the price an innovator will achieve depends very much on his bargaining position and not just on the market value of his invention. Underlying problems could be asymmetric costs of not trading relative to those of the counterparty (Rubinstein, 1982) and asymmetric risk of disappropriation in particular (Gans et al., 2002). Fourth, incumbents' return from radical innovations may be much lower than those for newcomers and fringe suppliers (or potential social returns from adoption), since incumbents' older assets will by definition lose some of their value in the course of radical innovation (e.g. Fellner, 1951; Arrow, 1962; Reinganum, 1983).

Following Plant (1934), humdrum innovation could thus be one of the alternative investments displaced by copyright protection. This type of concern is reflected in a scattered literature that criticizes copyright systems not for failing to promote content creation but for obstructing desirable technological change (e.g. David, 1993; 2004; Boldrin and Levine 2002; 2005). Emphasizing transaction costs, some authors argued that the copyright system may require protracted negotiations before innovative new services making use of copyrighted works can be introduced to the market (Merges, 1996; Einhorn, 2001; Depoorter and Parisi, 2002). Another argument is that incumbents may use intellectual property rights to sustain barriers to entry and resist radical technological change (Kim, 2007; Bhattacharjee et al., 2007).

Where this occurs, copyright could entail dynamic costs over and beyond what is acknowledged in much of the literature. The socially desirable level of copyright protection may thus be misapprehended where content creation is the only consequence taken into consideration. The equivalent argument applies to unintended consequences of other types of IP concerning incentives to innovate in areas not protected by it.

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<sup>2</sup> Cohen and Klepper (1996a:232; 1996b) even argue that “appropriability conditions confine firms to exploiting their innovations chiefly through their own output”. The discussion of trade is roughly analogous to that for R&D collaboration, as a special type of interaction through which humdrum innovators could come to benefit from greater profits of content creation (for a literature survey see Veugelers, 1998)

### III. COPYRIGHT AND RETURNS ON DIFFERENT TYPES OF INNOVATION – A SIMPLE MODEL

This section develops a model in order to discuss the effects of one type of IP on different types of innovation in an industry. The example is copyright and incentives for two types of innovation: first, content creation that concerns the development of new copyright works; second, humdrum innovation concerning the dissemination of existing copyright works. The starting point is a model developed by Landes and Posner (1989; 2003), which will be referred to as the LP model in the following.<sup>3</sup>

#### **A creator's profits in the presence of unauthorized copying**

Among other things, the LP model addresses a creator's profits from supplying original copyright works in the presence of a copier who supplies unauthorized copies. Creator profits depend on the demand for copies, the price of copies, production costs, and the share of demand satisfied by the unauthorized copier. The extent of unauthorized copying is inversely related to the strength of copyright protection, and greater copyright protection increases rights holder revenues. Copyright strength also drives up the costs of content creation because creators need to either clear copyrights or work around existing rights. Copyright thus increases the costs of content creation and the revenues to the creator.

A creator generates creative works and sells authorized copies of these works. Under typical copyright arrangements, the creator automatically becomes a copyrights holder, but the protection of his exclusive rights is usually not perfect.<sup>4</sup> Copiers free-ride on the costs of content creation and supply unauthorized copies, which are assumed to be perfect substitutes at least after quality adjustment. The copyright system influences the rivalry between creator and copier.

Creators have substantial fixed costs of production and non-increasing marginal costs. In contrast to a Bertrand duopoly model, marginal cost pricing is not an option. Let  $p$  be the price of copies set by the rights holder. Let  $q$  be the total number of copies demanded at that price.<sup>5</sup> Incomplete excludability and incomplete appropriability are typical of innovations (Arrow, 1962b; Nelson; 1984; Dosi, 1986).<sup>6</sup> Some unauthorized use may occur, which the model captures in the following way. The number of copies sold by the rights holder is  $x$ , and  $y$  is the quality-adjusted number of copies sold by the copier, so that  $x + y = q$ .

The excludability of content creations is  $z$ , with  $0 \leq z \leq 1$ . Excludability  $z = 0$  if a new good or service is perfectly inexcludable, and  $z = 1$  if no use without the permission of the innovator is feasible at all. Furthermore,  $z$  consists of two elements. First,  $z_n$  is the 'natural' excludability at a given state of copying technology.<sup>7</sup> Second,  $z_g$  is the excludability generated by a copyright system, so that  $z_n + z_g = z$ . In our model,  $z_g$  is the definition of copyright strength. For simplicity, let the excludability of creations without copyright be zero so that  $z_g = z$ . Let's further assume that the copier

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<sup>3</sup> In order to facilitate model extensions, the notation is adapted.

<sup>4</sup> This paper ignores the difference between the author of a copyright work and a firm purchasing copyrights from authors, such as record companies or publishers.

<sup>5</sup> The model does not incorporate demand uncertainty. Suppliers are assumed to approximate the market clearing number of copies through several production runs (in the case of physical copies) or by producing on demand (in the case of digital copies).

<sup>6</sup> For simplicity, the model makes no distinction between excludability and appropriability.

<sup>7</sup> The natural excludability depends on the copier's cost to acquire the first copy with which he can start reproducing (for example the retail value of an authorized copy) and on the costs of copying.

supplies all copies up to a point where  $p$  exceeds his marginal costs.<sup>8</sup> Then  $z$  determines the share of authorized and unauthorized copies in total demand, so that  $x = qz$  and  $y = q(1 - z)$ .<sup>9</sup>

Equation 1a displays the creator/rights holder's return on supplying copyright works  $\pi_r$  from the market for copies.

$$\pi_r = (p - c_c)x - f_e - f_c \quad (1a)$$

The marginal costs of copying are denominated as  $c_c$  and the fixed costs of copying as  $f_c$ . Following Landes and Posner, the costs of copying are broadly defined to cover all costs of reproduction, distribution, retailing and marketing. The marginal costs of copying are assumed to be constant.

The fixed cost of creation is  $f_e$ . The costs of creation are co-determined by copyright strength  $z$ . That is because this model does not define content creation as only the creation of something entirely new but allows for follow-up creativity.<sup>10</sup> The costs of creation thus rise with greater copyright strength  $z_g$ , since it becomes more costly to clear copyrights of other creators or to work around existing copyright claims. The relationship between  $f_e$  and  $z$  depends on the cost of clearing copyrights, and is influenced by specific copyright arrangements such as the definition of infringement, the probability and consequences of detection, but also on the transaction costs in trading copyrights, the share of copyrighted material in total inputs to content creations, the costs of unauthorized replication, and the bargaining position of rights holder and follow-up creator.

To relate  $f_{eg}$  and  $z$ , the LP model is extended in the following way. First, let  $f_{en}$  be the costs of creation without copyright, and let  $f_{eg}$  be the amount by which copyright arrangements affect the costs of content creation so that  $f_{en} + f_{eg} = f_e$ . Second, the coefficient  $\beta_{ez}$  stands for the change in  $f_{eg}$  with a change in  $z$ , so that for a firm holding no relevant copyrights itself  $f_{eg} = \beta_{ez} z$  with  $\beta_{ez} \geq 0$ .<sup>11</sup>

Spelling out  $x$  and  $f_e$  in equation 1a then produces:

$$\pi_r = (p - c_c)(q - qz) - f_{en} - \beta_{ez} z - f_c \quad (1b)$$

<sup>8</sup> This is another way of saying that the copier will undercut the price set by the rights holder by the lowest possible margin, adjusting for any difference in quality between authorized and unauthorized copies.

<sup>9</sup> This holds under the assumption that at very low  $q$ , the marginal costs of the copier are always lower than the fixed costs of the content creation. Where that is the case, the rights holder cannot set a single price at which he could recover his fixed costs and drive out unauthorized copying entirely, so that  $z > 0$ . The coincidence of high costs of creation and low marginal costs of reproduction are considered typical for copyright industries (e.g. Pethig, 1988). An exception may be  $q = 1$ , since the rights holder may have perfect control over the first copy (the master).

<sup>10</sup> Unauthorized copying occurs where there are no substantive differences between copyright works and copies. Content creation refers to situations where there are sufficient differences. The threshold is defined in legal practice.

<sup>11</sup> The coefficient  $\beta_{ez}$  is a somewhat artificial construct. The relationship between  $f_{eg}$  and  $z$  may not be linear. In the model, since  $z$  ranges between 0 and 1,  $\beta_{ez}$  is equal to a maximum of  $f_{eg}$ , when  $z = 1$ . Specifying the relation between  $z$  and  $f_e$  in this manner has one decisive advantage: it keeps  $z_g$  empirically measurable without information on production costs, especially where  $z_n = 0$  so that  $z_g = z$  (which seems to be a reasonably accurate representation of the situation in so-called digital markets). For copyright industries, data on the amount of unauthorized copying is more readily available than data on production costs.

Equation 2a illustrates the copier's return on supplying unauthorized copies to the same market  $\pi_u$ .

$$\pi_u = (p - c_c - y^b c_z)y - f_c \quad (2a)$$

Spelling out  $y$  gives:

$$\pi_u = \left( p - c_c - [q(1-z)]^b c_z \right) [q(1-z)] - f_c \quad (2b)$$

In contrast to the creator, the copier has no costs of content creation.<sup>12</sup> The copier faces the same copying costs  $c_c$  and  $f_c$  as the rights holder. This differs from the LP model, which assumes that the marginal costs of copying are constant for the rights holder and increasing for the copier.<sup>13</sup> Instead, in our model the copier also has marginal costs to avoid adverse consequences for his enterprise associated with the copyright system  $c_z$ . This additional cost to the copier is assumed to be a variable cost, with the marginal cost strictly increasing with  $y$ . The model assumes an exponential increase of total variable costs with increasing  $y$  (by an exponent  $b > 1$  that is probably not much greater than 1), but any monotonically increasing relationship will do. The underlying assumption is that a copier's costs of dealing with the copyright system increase with the number of copies he supplies.<sup>14</sup> More unauthorized copying is more likely to lead to litigation or to provoke other countermeasures by rights holders or public authorities.<sup>15</sup>

In the model, the fixed cost of the copier are lower than those of the rights holder but his variable costs are higher and increasing with output due to the additional position  $c_z$ . In this way, the model 'works' in much the same way the LP model does: it is consistent with the observation that unauthorized copying does not always drive out all content creation. In the model, the reason is that the rights holder can be at a cost advantage even when charging a price that exceeds the marginal cost

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<sup>12</sup> For simplicity, the model does not include the costs of acquiring the first copy that the copier needs to operate.

<sup>13</sup> For Landes and Posner (1989; 2003), this assumption is necessary to avoid a theoretically trivial and unrealistic result: since the copier enjoys an initial cost advantage of avoiding the fixed costs of content creation  $f_c$ , at equal copying costs the copier will always supply all copies ( $z = 0$  so that  $y = q$ ). In this situation, the rational supply of new creations would be zero and no market would exist. Nevertheless, the assumption that the marginal costs of copiers and rights holders differ in this way may seem questionable. (Landes and Posner (1989) rationalize this assumption with different copiers having different costs.) On the one hand, it is counterintuitive that the marginal costs should differ substantially for rights holders and copiers. On the other hand, digitization in the sector drives down marginal costs to a point where they may be close to zero even for very large editions (at least in some cases). It needs to be clear, however, that the costs of copying are broadly defined to include not only reproduction and distribution but also marketing costs and retailing. Reproduction and distribution seem very unlikely to increase or to differ substantially between rights holder and copier, at least in the digital realm. For marketing and retailing there may be some variation, due to the clandestine nature of copying. In real markets, some retailing options and marketing options may not be available to copiers. Advertising, for example, could draw unwanted attention from the rights holders or the authorities. To clarify the issue and to make the model more suitable to the current state of technology, we assume that the copier's marginal costs of copying are also non-increasing.

<sup>14</sup> Strictly speaking  $y$  does not represent an absolute number of copies but the share of the unauthorized copies supplied by the copier in the total number of copies sold  $q$ .

<sup>15</sup> What is more, if a single copier supplies a great share of all unauthorized copies, countermeasures could be facilitated.

of copying. The possibility that supplying original content is profitable in spite of unauthorized copying thus exists under the conditions set out in equation 3 a and b.

$$\frac{f_e + f_c}{p - c_c} < x \quad (3a)$$

Spelling out  $f_e$  and  $x$  produces:

$$\frac{f_{en} + \beta_{ez}z + f_c}{p - c_c} < qz \quad (3b)$$

The copier will supply unauthorized copies up to the point at which his marginal costs are equal to the price of authorized copies  $p$ . Supplying authorized copies will be worthwhile where the copier's marginal costs rise quickly enough to exceed  $p$ , so that the remaining share of total demand supplied by the rights holder is large enough to recover fixed costs (at a given price above the creators' marginal costs).<sup>16</sup>

The model implies that, *ceteris paribus*, the number of copies sold by the rights holder will increase with copyright protection until they reach a maximum at  $z = 1$ . At the same time,  $z$  drives up the fixed costs of creation  $f_e$ . Where an optimal balance is struck between these two effects, investment in content creation is maximized.<sup>17</sup> Under the simplifying assumptions of no natural excludability of copyright works and perfect substitutability between authorized and unauthorized copies, the model does imply that copyright protection is a necessary precondition for profitable content creation. The model does not include a number of complications that could mitigate the need for copyright to enable content creation, however.<sup>18</sup>

In any case, the point of this article is not to assess the absolute need for copyright. It is to contrast the effect of copyright on content creation with its effect on humdrum innovation. The following section extends the model to discuss innovation in greater detail.

### **The returns of content creation**

The LP model assumes rational creators, who make an instantaneous investment decision based on perfect information about all future returns. In order to discuss innovation incentives, we introduce several extensions.

On the one hand, the LP model does not allow for unforeseen changes to market conditions – for example the diffusion of more powerful copying technology –

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<sup>16</sup> The challenge for the rights holder is thus to set  $p$  so as to maximize his profits. Copyrights holders may also invest in copyright protection driving up  $z$  and  $x$ . For the purpose of this paper, copyright protection is treated as exogenously determined.

<sup>17</sup> This would translate into a maximization of the diversity of supply, assuming free entry and that creators' differ in their costs of creating equivalent works, some being more efficient than others (cf. Landes and Posner, 1989).

<sup>18</sup> Noteworthy omissions are: (1) differences between authorized and unauthorized copies in the perception of consumers (modeled in Besen and Kirby, 1989?; for empirical evidence see Rochelandet and Guel, 2005; or Rob and Waldfogel, 2006); (2) first-mover advantages (modeled in Watt, 2000; see also Boldrin and Levine, 2002); (3) the potential for price discrimination and indirect appropriability (Liebowitz, 1985); (4) additional sources of income to creators and network effects (Takeyama, 1994); (5) or intrinsic motivation (Frey, 1997; Caves, 2000). Landes and Posner (1989) already provided an overview of such complications, which was updated in particular with a view to digitization in Landes and Posner (2003). The analysis in this paper further sidelines many of the complexities associated with product differentiation and differentiated preferences as discussed in Johnson (1985).

and subsequent adaptation. However, copyright works are durables that can give rise to durable rents (Caves, 2000), and copyrights last for fifty years or more. It seems highly probable that over such long periods of time, unforeseen events occur. What is more, the fixed costs of creation are typically sunk, so that they will be irrelevant for rational suppliers' decision after they have been committed. Therefore, incentives to continue to supply copies of existing copyright works after a change in market conditions will differ from incentives to conduct content creation.

Content creation is modeled as product innovation that increases the demand for copies of all copyright works supplied by the firm. In this way, the complexities of product differentiation (e.g. Johnson, 1985) can be avoided. Demand at a point in time  $t$  before this type of innovation is lower than at a point in time  $t'$  after the innovation ( $q_{t'} > q_t$ ). The change in demand is represented by  $\Delta q$  so that  $q_{t'} - q_t = \Delta q$ . If content is subject to depreciation, content creation may only increase demand at  $t'$  in comparison to what demand would have been without this type of innovation.<sup>19</sup>

Furthermore, the LP model does not address differences between creators/rights holders and interactions between them. For example, rights holders will accumulate a catalogue of rights over time.<sup>20</sup> The costs of clearing rights held by the firm should be much lower than those held by others, which will affect the costs of follow-up creativity and innovation. To capture this, our model includes the 'market share' of the relevant copyrights already held by the firm  $m$ , with  $0 \leq m \leq 1$ ;  $m = 1$  means that the firm holds all relevant copyrights and  $m = 0$  means that the firm holds no relevant copyrights whatsoever at the outset.<sup>21</sup>

Extending on equation 1b, the returns on content creation  $\pi_e$  can then be expressed in equation 4.

$$\pi_e = (p - c_c)(\Delta q - \Delta qz) - f_{en} - \beta_{ez}(1 - m)z - f_c \quad (4)$$

For the returns on continuing to supply existing copyright works  $\pi_s$ , the sunk costs of content creation are irrelevant. Excluding them produces:

$$\pi_s = (p - c_c)(q - qz) - f_c \quad (5)$$

The implication is that the supply of new copyright works is more sensitive to adverse changes in market conditions for creators (say an increase in unauthorized copying) than the supply of existing copyright works.<sup>22</sup> In the formal analysis, the supply of

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<sup>19</sup> Since copies are durable, repeat purchase of the exact same content is rare. Therefore, demand tends to decrease over time without further content creation. Other reasons for depreciation are innovation by other firms, including supply of close substitutes by imitators, as well as changing consumer preferences over time. Content creation may thus often be a means to sustain rather than expand demand for a firm's output. This analysis is consistent with the observation that many suppliers of copyright works conduct content creation continuously.

<sup>20</sup> This issue is mentioned in Landes and Posner (1989) but not addressed in the formal analysis.

<sup>21</sup> We ignore the following complication here. In comparison to trading rights, drawing on copyrighted content to which the firm holds copyrights will not generate transaction costs, and entail less information problems or opportunistic behavior. However, follow-up creativity may still be costly to the rights holder, where a new work that is similar to other works in the possession of the rights holder is a close substitute and displaces some demand for works it drew upon.

<sup>22</sup> Assuming the demand for existing and new works to be independent and homogenous copying costs, the only difference between a rights holder that conducts no content creation and the copier will be the copiers' costs of avoiding litigation due to copyright infringements. Without effective copyright protection or other barriers to entry, there will be perfect competition between rights holders and

existing works is not affected by unauthorized copying at all. The mode of adaptation for suppliers of copyright works will be to change investments in content creation.

An important aspect of the interaction between different creators/rights holders is the licensing/trading of innovations. In our model, copies are consumer goods. Content is a capital good used to generate attractive copies. Assuming some excludability, the creator may supply copies and/or license commercial users to do so. The creator may also license follow-up creators, or opt not to license and enjoy an advantage over competitors from exclusive use of an innovation. For simplicity, the returns of exclusive use by the creator are assumed to be equivalent to the returns from licensing copyrights to follow-up creators.<sup>23</sup>

The costs of licensing follow-up innovation such as content creation are of particular interest. Holding the natural costs of content creation  $f_{en}$  constant and assuming that the costs of working around existing copyright claims will be higher than the costs of clearing rights, the costs of content creation  $f_e$  will strictly increase with  $z$  and be at a maximum at  $z = 1$ . Assuming no opportunistic behavior exploiting asset specificity, the costs of clearing rights for follow-up creativity  $f_{eg}$  will be at least equal to the costs of trading rights. Depending on the bargaining position of rights holders and follow-up creator, and assuming freely negotiated prices for copyright licenses,  $f_{eg}$  will range between this minimum and the net market value of the innovation minus development costs  $f_e$ .

### **The returns of humdrum innovation**

The profits of any firm supplying copyright works do not only depend on their ability to create copyright works efficiently. They also depend on their costs of copying as defined above. Depending on (the potential for) productivity increases, suppliers of copyright works may need to adopt innovations in either of these two realms in order to sustain their competitiveness over time.

Humdrum innovation is modeled as process innovation that reduces the costs of producing a given output. Humdrum innovation may reduce the fixed costs of creating a copyright work of a given quality, so that the costs of creation at a point in time  $t$  before the innovation are greater than the costs of creation at a point in time  $t'$  after the innovation. The change in costs is represented by  $\Delta f_e$ , with  $f_{et} - f_{et'} = \Delta f_e$  and  $f_{et} > f_{et'}$ . For example, this type of innovation will benefit the rights holder in competition with a copier, since it will reduce any initial cost advantage for the

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copiers. (Then,  $x$  could take any number between 0 and  $q$ . Substantial sunk costs will be a barrier to entry. If the costs of creation are sunk but fixed costs of copying are not, follow-up creators may be more affected by copyright protection than copiers.) Prices for copies of existing works will be equal to marginal costs, and there will be no investments in content creation. If content is subject to depreciation, demand would eventually approach zero. With effective copyright protection and no content creation, the rights holder will supply all copies of existing works, but prices and profits would not exceed the costs of copyright protection imposed on copiers. These profits may motivate sufficient investment in content creation to compensate for depreciation. If not, demand would also approach zero but at a slower rate.

<sup>23</sup> Therefore, the formal model does not include licensing as a separate source of income in addition to selling copies. As emphasized above, trading innovations will be costly. Firm growth to fully exploit an innovation is also be costly, however, so that it is not a given that exploiting an innovation within the firm would always be the best option. The number of potential users will be ambivalent regarding the returns of innovation to a licensing innovator. On the one hand, transaction costs should decrease with the number of licensees. On the other hand, the market power of potential users should decrease with the number of potential users. Assuming that the innovator has some market power, too, there will be a tougher bargain. The innovator will be subject to asset specificity with one user so that a monopolistic user can bargain for a license fee that may even be lower than development costs.

copier. Humdrum innovation could also affect a rights holder's copying costs (so that  $c_{ct} - c_{ct'} = \Delta c_c$  and  $c_{ct} > c_{ct'}$ ; or  $f_{ct} - f_{ct'} = \Delta f_c$  and  $f_{ct} > f_{ct'}$ ). This type of innovation will benefit the innovating rights holder as long as the copier does not adopt.

Ceteris paribus, the return on humdrum innovation depends on the cost reduction provided by the new technology  $\Delta f_e$ , the excludability of the new technology  $w$  and its development costs  $f_h$ . The excludability term of a humdrum innovation  $w$  is constructed analogously to the excludability of content creations  $z$ . That is  $0 \leq w \leq 1$ , and  $w = 0$  means perfect inexcludability (competitors adopt completely and at an instance) whereas  $w = 1$  means perfect excludability (competitors never adopt any aspect of the new technology without license).

The fixed development costs of a humdrum innovation are constructed analogously to the costs of content creation. Total development costs are  $f_h$ . Since copyright covers reproduction, modification and in particular distribution rights, copyright protection will also affect the developments costs of humdrum innovation, unless the firm holds all relevant copyrights. The costs of humdrum innovation without the need to clear copyrights is  $f_{hm}$ , and the costs of clearing copyrights for this type of innovation is denominated as  $f_{hg}$ , so that  $f_{hm} + f_{hg} = f_h$ .<sup>24</sup> Furthermore,  $\beta_{hz}$  is the coefficient describing the effect of a change in  $z$  on  $f_{hg}$  changes, and  $m_s$  is the share of all relevant copyrights held by the innovative firm as discussed above, so that  $f_{hg} = \beta_{hz}(1-m_s)z$ .

As before, we discuss the returns to humdrum innovation lowering fixed costs  $\pi_h$  as if the returns from multiple licensing are equal to exclusive use of the technology. Assuming some excludability and the presence of several suppliers of copyright works, the innovator of a way to reduce production costs has a choice regarding the number of licenses. If the innovator commercializes copyright works, he may opt not to license and enjoy a cost advantage over competitors. If the innovator does not commercialize works, he will always wish to license. He may still choose the adequate number of license agreements, subject to the effects of increasing the number of licenses on willingness to pay per license and the transaction costs in trading the innovation.<sup>25</sup>

#### Humdrum innovation lowering fixed costs

There are some noteworthy differences between innovation concerning fixed costs and variable costs, and these two types of humdrum innovation are discussed separately. Equation 5a addresses the returns of an innovation lowering the fixed costs of copying.

$$\pi_h = \Delta f_c - \Delta f_c(1-w) - f_h = \Delta f_c w - f_h \quad (5a)$$

Spelling out  $f_h$  produces:

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<sup>24</sup> Humdrum innovation may also be protected by IP law, for example by patents. We assume that any IP protection for humdrum innovation remains constant, so that it does not have to be discussed as a separate component of  $w$  for the purpose of this paper. For other purposes, symmetry may dictate that any costs to the creators and innovators from clearing IP rights to technical inputs need to be incorporated into the model.

<sup>25</sup> Over time, the number of firms operating in the market and thus the potential number of licensees depends on fixed costs of production, since lower fixed costs will facilitate market entry. Therefore incumbent firms who own copyrights should have less of an interest in innovation lowering fixed costs than firms who own no copyrights.

$$\pi_h = \Delta f_c w - [f_{hn} + \beta_{hz}(1-m)z] \quad (5b)$$

For the fixed costs of content creation  $f_e$ , the returns can be calculated in a similar manner to equation (5b). One difference is that any benefits will only transpire at the next occurrence of content creation. Another difference is that for  $f_e$ , a copier cannot adopt, so that the rights holder enjoys perfect excludability of his innovation in this area ( $w = 1$ ) if only faced by competition from a copier.

#### Humdrum innovation lowering variable costs

For innovations lowering the variable costs of copying  $c_c$ , calculating the cost reduction is slightly more complex because it depends on the number of authorized copies sold and thus on copyright protection  $z$ . The development costs are calculated in the same way as those for other types of innovation – see equations 6a and b.

$$\pi_h = \Delta c_c xp - \Delta c_c xp(1-w) - f_h = \Delta c_c xpw - f_h \quad (6a)$$

Spelling out  $f_h$  as well as  $x$  gives:

$$\pi_h = \Delta c_c qzw - [f_{hn} + \beta_{hz}(1-m)z] \quad (6b)$$

For all types of humdrum innovation, the model captures the trivial insights that returns on innovation increase, the greater the cost reduction due to the innovation, the greater the excludability of the new technology, and the lower development costs. On this basis, the following section further illustrates the effect of copyright on innovation.

#### **The effect of copyright on innovation**

To discuss the effect of copyright on innovation, this section inspects the consequences of an increase in excludability  $z$  due to an increase in copyright protection  $z_g$ . In the formal model, this is expressed by a change in copyright protection  $\Delta z$  between a point in time  $t$  and a later point in time  $t'$  so that  $\Delta z = z_{t'} - z_t$ , with  $z_{t'} > z_t$ . Any IP protection for humdrum innovation remains constant.

#### Content creation

Building on equation 4, the effect of a change in copyright protection on the return on content creation  $\Delta\pi_{rz}$  is modeled in equation 7a.

$$\Delta\pi_{rz} = (p - c_c)(\Delta q - \Delta q \Delta z) - f_{en} - \beta_{ez}(1 - m_s)\Delta z - f_c \quad (7a)$$

For simplicity, the rights holder only adjusts the quantity of copies supplied  $q$  after an increase in demand for authorized copies with greater copyright protection – prices are assumed to be constant. The natural fixed costs of expression  $f_{en}$  and the fixed costs of copying  $f_c$  are unaffected by a change in copyright protection. An increase in copyright protection will then increase the returns on content creation where the condition expressed in equation 7b holds.

$$(p - c_c)(\Delta q - \Delta q \Delta z) > \beta_{ez}(1 - m_s)\Delta z \quad (7b)$$

The consequence of greater copyright protection on the returns of content creation depends on two opposite effects: first, the additional number of works sold by the creator increases the creator's revenues; second, the fixed costs of expression increase due to greater costs of clearing other creators' rights. For the net effect, one decisive issue is the way that copyright strength  $z$  (measured as the share of total supply coming from the copier) translates into greater costs of creation, captured by the coefficient  $\beta_{ez}$ . This is a question of specific arrangements in the copyright system. The ideal copyright system would have a  $\beta_{ez} = 0$ . The greater  $\beta_{ez}$ , the greater will be the probability that follow-up creativity is restricted more effectively than unauthorized copying. That would be the case, for example, because follow-up creators have greater sunk costs and thus run a greater risk from copyright litigation than pure copiers, or because follow-up creativity is more easily detected than pure copying. Under those conditions, it would be more likely that greater copyright protection decreases content creation.

Furthermore, a net increase in content creation due to stronger copyright protection is more likely, the higher demand for a copyright work is to start with, and the greater the share of relevant copyrights held by the firm. This may provide a simple explanation for the casual observation that many large, incumbent copyright holders lobby for strong copyright protection, whereas many fringe suppliers do not. Part of the explanation may simply be: (a) that suppliers of popular works can spread any fixed costs of dealing with copyright over a greater number of copies sold; and (b) that firms holding relevant copyrights have lower costs of clearing rights.<sup>26</sup>

### Humdrum innovation

#### *Fixed costs*

For humdrum innovation that reduces fixed costs, several items in equation 5b are unaffected by a change in copyright protection. This holds for the cost reduction offered by the innovation  $\Delta f_c$ , its appropriability  $w$ , and the natural development costs irrespective of copyright  $f_{hn}$ . Then, the effect of a change in copyright protection on the returns from this type of innovation is:

$$\Delta \pi_{hz} = -\beta_{hz}(1-m)\Delta z \quad (8)$$

The main point is that an increase in copyright protection will always diminish the returns on this type of innovation, unless the innovative firm holds all relevant copyrights at the outset ( $m = I$ ), in which case there will be no effect. Holding other things equal, greater copyright protection does not affect the returns of humdrum innovations that reduce fixed costs, but it does increase the costs of innovation.<sup>27</sup> For

<sup>26</sup> Other suggested explanations are: first, benefits for fringe suppliers who compete with large incumbent firms from 'sampling' or 'exposure effects' through unauthorized copying (e.g. Peitz and Waelbroeck, 2006); and second, revenues to rights holders from more concentrated related markets (Kim, 2007).

<sup>27</sup> A notable exception may occur where greater demand for authorized copies due to greater copyright protection triggers market entry. In that case, an innovative firm may benefit from greater demand for licenses of a technology lowering fixed costs (or from being better shielded from new competitors due to a cost advantage). However, as argued below, greater copyright protection will tend to benefit large incumbent firms over newcomers. Market entry due to greater copyright protection will probably be modest and copyright may even result in greater concentration. In the latter case, demand for an innovation that reduces fixed costs may increase with greater income of creators/rights holders but the stronger bargaining position of large incumbent firms could adversely affect the price of licenses.

the returns of innovation affecting the fixed costs of creation the right hand side of the equation is the same as equation 7.

Any increase in content creation due to greater copyright protection will come at the expense of less humdrum innovation of these types. The extent to which greater copyright protection diminishes returns on this type of innovation will be greater, the greater  $\beta_{hz}$  and the fewer relevant copyrights the firm holds at the outset.

#### *Variable costs*

Equation 9a models the effects of a change in copyright protection  $\Delta z$  on the returns on humdrum innovation that reduces the variable costs of copying.

$$\Delta\pi_{hz} = \Delta c_c q \Delta z p w - f_{hm} - \beta_{hz} (1 - m) \Delta z \quad (9a)$$

As before, the natural development costs are unaffected. Then a change in copyright protection increases returns on this type of innovation under the following condition:

$$\Delta c_c q \Delta z p w > \beta_{hz} (1 - m) \Delta z \quad (9b)$$

Returns from this type of innovation depend on  $q\Delta z$ , the additional number of copies supplied by the rights holder (or by licensees). Any increase in  $z$  will increase the revenues to rights holders from this type of humdrum innovation. At the same time, an increase in  $z$  will raise the fixed development costs. There are parallels to the case of content creation. On the one hand, a central issue is the relative effect  $\beta_{hz}$  of greater copyright strength on (a) the number of copies supplied by the creator  $z$ , and (b) development costs. The greater  $\beta_{hz}$ , the greater is the probability that an increase in  $z$  will obstruct innovation affecting the variable costs of copyright. On the other hand, greater prices of copies  $p$ , greater demand  $q$ , and relevant copyright endowments  $m_s$  make it more likely that stronger copyright protection increases the returns on innovation of this type. Again, for suppliers of more popular works, and firms that hold more relevant copyrights, greater copyright protection is more likely to increase innovation returns.

#### *Combined effects*

The typical economic rationale for copyright is that it increases the returns of content creation. Over time, an effective copyright system influences the rate of change in the quantity and quality of creative works available in a given market. According to our analysis, copyright also influences the returns of humdrum innovation in markets for copyright works. Over time, copyright thus co-determines the rate of change in the media infrastructure, and the extent to which existing copyright works are available throughout society. Our analysis further illustrates that the effects of copyright on the returns of various types of innovation differ.

Including unintended consequences of copyright on humdrum innovation, the socially desirable level of copyright protection may diverge from estimates that only take account of content creation. The innovation costs of copyright concerning humdrum innovation are not only of interest when they exceed the innovation benefits concerning content creation. That is because many aspects of copyright policy are scalable – for example the duration of rights, public investments in enforcing rights,

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Finally, in the extreme (and improbable) case of no supply of copyright works being profitable, there would also be no returns on humdrum innovation.

and fair use exceptions – so that copyright policy is not about a binary choice but about approximating an optimal balance of costs and benefits. The unintended consequences of copyright on humdrum innovation (which could be negative or positive) are likely to alter this optimal level of copyright protection, even if some copyright protection remains to be socially desirable.

### **Summary of model implications**

According to this analysis, an extension in copyright policy does not only affect content creation but also humdrum innovation. This effect goes beyond Plant's (1934) insight that any additional content creation encouraged by copyright protection could come at the opportunity cost of replacing the marginal amount of alternative activities such as humdrum innovation.

Copyright is usually addressed as a costly means to promote content creation. This exploration of the effects of copyright on humdrum innovation distinguishes between innovations lowering fixed costs (of either content creation or copying) and variable costs. For fixed costs, greater copyright protection diminishes returns on humdrum innovation, as long as any market for copyright works exists and the innovator does not hold all relevant copyrights at the outset. For variable costs, results are less clear-cut and similar – but not identical – to the case of content creation. A level of copyright protection that strikes a socially optimal balance regarding content creation cannot be relied upon to do so for humdrum innovation.

A decisive issue is the effect of copyright on the extent of unauthorized copying relative to its effect on the costs of innovations that make use of copyrighted works. The transmission mechanism between these two countervailing effects of copyright on innovation is modeled simply as a coefficient by which the costs of innovation increase with a decrease in unauthorized copying due to copyright protection. Specifying this transmission mechanism and its determinants would be useful to control for unintended consequences of copyright policy.

Our model also implies that greater copyright protection has asymmetric effects on different types of firms. Copyright is less likely to decrease innovation returns of firms that supply more popular works and hold more substantive copyright assets. A 'high protection'-environment would thus favor large incumbent firms.<sup>28</sup> With greater copyright protection, incumbents enjoy a cost advantage regarding innovation. Over time, greater copyright protection increases incumbents' competitiveness relative to smaller firms and newcomers.

Finally, the model allows for some inferences on the maximum innovation costs of copyright. To some extent, the innovation cost of copyright will increase with greater technological opportunities. However, regarding the private costs to rational firms, the innovation costs of copyright will not exceed the costs of trading innovations, including the problem of overcoming information deficiencies. Unfortunately, the literature suggests that these costs tend to be high in markets for information goods and technologies.<sup>29</sup> Furthermore, because the innovation costs of copyright will be greater for small firms and newcomers, copyright may inhibit the contestability of markets. The relationship between competition/contestability and innovation is a complex issue, but it seems that dominant incumbents have lower

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<sup>28</sup> Regarding the effects of copyright on content creation and industry structure, Benkler (2002) makes the same point. For process innovation, Cohen and Klepper (1996a) also suggest that large firms have greater incentives to innovate.

<sup>29</sup> Furthermore, regarding the uncertainty associated with technological change, rational behavior may also be a strong assumption (e.g. Edquist, 1997; Lipsey et al., 2005).

incentives to innovate than would be socially desirable in particular concerning radical innovation (e.g. Reinganum, 1983).

To be sure, unintended consequences on humdrum innovation could be modest, and theoretical results on the total innovation effect of copyright are not clear-cut. Depending for example on technological opportunities, the costs of trading innovations, and the extent to which greater copyright protection translates into innovation obstacles, returns to innovation may be unaffected, increased or diminished with greater copyright protection. It is an empirical question whether copyright does affect humdrum innovation in a substantial way. Of particular interest is the net innovation effect of copyright, considering content creation and humdrum innovation. The following section discusses an empirical example in order to establish whether copyright does affect humdrum innovation, and how strong this effect is compared to effects on content creation.

#### IV. AN EMPIRICAL APPLICATION – RECORD COMPANIES, DIGITIZATION AND COPYRIGHT

The potential for humdrum innovation complicates the case for copyright. The question is not only whether copyright promotes content creation so that the long-run benefits from innovation exceed administration costs and access costs to users. Even if that is the case, the rationale for copyright still depends on the proportion between intended benefits regarding content creation and any unintended, adverse consequences regarding humdrum innovation. This section investigates that proportion for a specific type of suppliers of copyright works.

Valid data on the use and consequences of IP on innovation is hard to come by since innovation is a multifarious concept that is difficult to measure directly and comprehensively. IP also has countervailing, complex effects on innovation. What is more, one of the basic empirical insights about innovation and technological change is that it waxes and wanes irregularly over time with changing technological opportunities (e.g. Abernathy and Utterback, 1975; 1978; Klepper, 1996). Therefore, empirical results are likely to be context specific, and it is hard to isolate the net effect of IP on innovation.

#### **Method**

##### Data collection

As a short-cut, research on IP and innovation has often taken recourse to firm-level surveys (e.g. Mansfield, 1986; Cohen et al., 2000; OECD, 2001).<sup>30</sup> In an influential

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<sup>30</sup> There are several popular shortcuts to empirically assess the effect of IP on innovation, without measuring innovation directly. The first is to focus on the relationship between IP protection and rights holder revenues. A problem in this approach is that IP affects both revenues and costs of innovators, so that returns on innovation do not reliably increase with greater revenues (Watt, 2000). Even if IP provides a net incentive for innovation, the elasticity of innovation to any additional returns from IP needs to be specified to justify public investments in IP systems. A second shortcut is to infer from IP registrations that there is a net financial benefit to innovative firms, so that IP encourages innovation. Even for patents, this is questionable. The reason is that firms rarely have the choice between a world with or without IP. They usually decide on IP usage in the presence of other firms having the same option. The problem could be coached in terms of a prisoners' dilemma, where IP usage could be the preferred, but not the optimal choice (cf. Benkler, 2002). For copyright, IP registrations are even less indicative of net benefits to rights holders, since copyright applies automatically and at miniscule costs to the creator. Whereas patents are costly to an inventor and reserved for inventions that meet specific criteria, it may even require an effort for a creator to drop copyrights. It seems that some rights holders

study on the appropriation of R&D returns, Levin et al. (1987) discussed the relative merits of survey data – including the use of semantic scales – compared to the available information on prices, costs and input-output quantities such as R&D expenditure and patents. Given similar data restrictions and the complexity of the relationship between IP and innovation, this paper also opts for a survey, in which the research strategy is not to observe (representations of) firms’ economic behavior but to capture ‘informed opinions’ on IP and innovation.

#### Case selection and timing of the survey

For a survey of this type to bring up relevant and valid results, it is desirable to address firms who have extensive, recent and first-hand experiences with (1) infringements of their IP rights, and with (2) clearing IP rights in order to conduct innovation. The data comes from a survey of small German record companies held in the summer of 2005. At the time, record companies seemed highly likely to have regular experiences regarding the consequences of IP on innovation.

First, under current copyright arrangements, record companies are defined as firms that acquire and commercialize copyrights to sound recordings. One aspect of their activities is to supply authorized copies. Second, there was substantial unauthorized use of the relevant type of copyright works in the period investigated. The example of the record industry has received much attention in debates on copyright reforms because with the diffusion of digital copying technology, copyrighted sound recordings were subject to relatively intense unauthorized copying early on. Widespread use of CD-burners and file-sharing networks coincides with falls in the primary market for sound recordings (in which authorized copies are sold to end-consumers). In the German market, turnover (at retail prices and in real terms) fell by over 40% between 1999 and 2005. Other major markets exhibited similar reductions in sales of authorized copies over the same period (Handke, 2010). Third, record companies regularly make use of copyrights held by others. Like many suppliers of copyright works, they often play a dual role. They are simultaneously rights holders and users of copyrighted works owned by others, subject to the types of products supplied and specific copyright arrangements. Record companies are usually primary rights holders to aspects of the recordings they commercialize. At the same time, record companies also need to ‘clear’ copyrights held by others, for example by authors, publishers and performing artists, in order to commercialize sound recordings, or they need to work their way around existing copyright claims. Fourth, in addition to content creation, record companies were likely to conduct humdrum innovation in the period studied, adopting ICT applications. These initial assumptions were confirmed by survey results.<sup>31</sup>

Our theoretical analysis predicts that the balance between innovation costs and innovation benefits is different (more beneficial) for larger incumbent firms than for

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drop out of the copyright system informally, by not enforcing their rights themselves. For users of such works, some legal uncertainty may remain, and collecting societies may still enforce rights within their realm. Under these circumstances, inferences from IP usage on net returns to innovators may be misleading.

<sup>31</sup> Virtually all responding firms reported some income from commercializing copyrights to sound recordings, and 99.5% had published new sound recordings in 2004. In the two and a half year period between the beginning of 2003 and the July 2005, the share of firms retailing physical sound-carriers via online-shops has increased from 53% to nearly 86% and the share of firms commercializing downloads has risen from 4% to 57% (Handke, 2010).

the smaller record companies surveyed for this study.<sup>32</sup> That is, results cannot be generalized for all record companies. However, as argued above, it is not necessary that the total innovation costs of copyright exceed its innovation benefits in order for unintended consequences on technical innovation to matter for copyright policy. It is one advantage of studying fringe suppliers that any innovation costs of copyright should be particularly visible among this type of suppliers, where the countervailing benefits of copyright are probably less pronounced.

#### Basic information on the survey

The data comes from a survey of the ‘German Association of Independent Record Companies’ (VUT), which ran in summer 2005. There are financial incentives for German record companies to join the VUT because members enjoy a 20% rebate on obligatory payments to the authors’ collecting society GEMA per reproduction of a copyrighted work (so-called mechanical royalties). Some larger record companies are not captured in the VUT survey because they are only members of another industry-lead body – the ‘International Federation of the Phonographic Industry’ (IFPI) Germany in which the major four record companies play a leading role – that offers further concessions with the GEMA for a higher annual membership fee.

The VUT survey addressed basic firm characteristics, such as turnover, employment and the range of activities conducted by the organization. It also covered information on expenditure, output and revenues as well as a range of innovation indicators. Large parts of the VUT survey are modeled on the ‘Oslo Manual’ on guidelines for investigating technological innovation (OECD, 1992; 1997; see also 2001; 2005) and on the major European survey of industrial innovation, the Community Innovation Survey (CIS) that runs regularly under the auspices of the EU and the OECD.

For the survey, a list of 1,013 contact partners in as many member firms was available. Previous surveys among this type of firms had resulted in low response rates. Therefore, no prior sampling was employed and the survey addressed all VUT members. Contact partners were owners and/or executives. They received emails with an introduction and a unique, personal access code to the online survey on firm characteristics and activities. The survey was online between 18 July and 22 August 2005. There was little valid and recent information on the characteristics of independent record companies available prior to the survey. The characteristics of respondents were checked against the limited information to check for self-selection bias. The share of corporations with a turnover over €500,000 and €1 million, the share of firms founded before 1999 or in the periods between 2000-2002 and 2002-2004, and the extrapolated turnover of ‘indies’ in comparison to estimates of IFPI Germany estimates all lay within the expected parameters. Overall, respondents of the VUT survey are assumed to be a reasonable approximation of a representative sample of small, independent record companies in Germany.

#### **Results on the innovation costs of copying and of the need to clear copyrights**

In order to investigate the innovation effect of copyright when humdrum innovation is included into the analysis, it is desirable to assess the innovation costs and innovation benefits related to copyright protection separately, as precisely as possible and symmetrically in order to establish relative weight. This was approximated in the following way.

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<sup>32</sup> Preliminary empirical support that fringe suppliers fare relatively better in the presence of digital copying is found in Blackburn (2006), Bhattacharjee et al. (2007) and Handke (2006; 2010).

The survey contained a matrix question, which assessed the significance of eleven factors hampering innovation (also referred to as innovation obstacles below). Respondents were asked to 'rate how important the following factors are in hampering or preventing innovation activities in your enterprise'. The method is adopted from the Community Innovation Survey (CIS) (see OECD, 1997; 2001; Eurostat, 2008). Respondents could mark one of four options to signal the perceived importance of factors: 'high' (coded as 1), 'intermediate' (2), 'low' (3), 'is no obstacle' (4). The eleven factors were programmed to appear in random sequence to avoid order bias.

This question on 'innovation obstacles' was immediately preceded by questions on the innovation activities of the firm. These addressed technical innovation as well as content creation. Respondents thus had a guideline that the concept of 'innovation' referred to both these types of innovation for the purpose of the questions on innovation obstacles.<sup>33</sup>

In order to assess the balance between innovation costs and innovation benefits of copyright, the matrix question on innovation obstacles featured two separate sub-questions related to copyright. The rating of the 'difficulties clearing copyrights or related rights for innovative projects' provides an indication of the perceived innovation costs of the copyright system. The rating for 'difficulties with enforcing [the firms'] own copyrights and related rights' provides an indication of the innovation cost of unauthorized copying and thus, by implication, the potential benefits of greater copyright protection.

This method approximates a symmetric measure reasonably well, but the precision that can be achieved through the use of a semantic scale is limited. Given the lack of alternatives, comparing the central tendency in responses regarding the two innovation obstacles should still provide a useful indication of the balance struck by copyright regarding its effects on innovation.

(TABLE 1)

(TABLE 2)

See table 1 for a list of variables and table 2 for survey results on the dependent variables. A greater number of respondents report that the need to clear copyright constitutes a 'high' or 'intermediate' obstacle to innovation (41.8%) than they do for unauthorized copying (32.4%). Table 2 documents three tests whether the difference in the central tendency of responses to these two questions is significant. In the social sciences, statistical analysis of discrete, ordinal variables produced through semantic scales often proceeds 'as if' they were equidistant and parametrically distributed. Adopting a more conservative approach, table 2 reports three complementary, non-parametric statistical tests: on the one hand, two rank-based tests for significant differences in the mean, treating the data as though it were equidistant but not normally distributed (Wilcoxon signed-ranks test and Friedman's ANOVA); on the other hand, a Chi-square test that is not based on the assumption of equidistance. In all three tests employed, the central tendency concerning 'difficulties clearing copyrights' is significantly lower than that for 'difficulties enforcing copyrights' ( $p < .01$ ). This suggests that the independent record companies surveyed perceive the

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<sup>33</sup> By providing such a guideline, the VUT survey adopted an 'object approach' and diverged from the CIS. For a discussion of 'object' versus 'subject approaches' for innovation surveys in the cultural industries see Handke (2010). For a general discussion see OECD (1997; 2001).

clearance of rights to entail greater obstacles to innovation than the possibility of unauthorized copying due to a lack of copyright enforcement.

This finding is consistent with relatively great, adverse effects of copyright on innovation under the current market conditions of the record industry. Taking copyright strength as a whole, a lower level of copyright protection appears desirable where these consequences on humdrum innovation are included. Another way to look at this is that any measures controlling unauthorized copying should be designed so as to avoid obstacles to follow-up innovation.

### **Firm characteristics and the importance of copyright related innovation obstacles**

As argued above, innovation incentives due to copyright should vary with firm characteristics. In order to test for effects of firm size and other firm characteristics on the perceived effect of copyright on innovation, a logistic regression was run. The results are presented in table 3. Survey results on copyright related innovation obstacles are quite stable throughout the sample. With one exception, the analysis identifies no significant differences between firms' reports on copyright related innovation obstacles and indicators of (a) firm size, (b) the extent to which firms are specialized on the core functions of a record company (the acquisition and commercialization of copyrights to sound recordings), (c) firm age, (d) firm growth, or (e) a firm's involvement in technical innovation. Within the sample of small, independent record companies, firm size seems to have little influence on the perceived innovation effect of copyright. The only significant predictor is the age of the firm for problems with the clearing of rights. Younger firms find the need to clear rights for innovative projects somewhat more obstructive. This is consistent with our theoretical result that the build-up of copyright assets reduces the costs of clearing rights. It is also consistent with a learning curve in handling rights.

(TABLE 3)

(TABLE 4)

## V. CONCLUSIONS

This paper deals with an aspect of the economic implications of IP that has received relatively little attention. Rather than focusing only on the impact of IP on the type of innovations protected by it, it also incorporates the consequences of IP on other types innovations. The argument is developed regarding copyright.

A simple model demonstrates that in principle, copyright arrangements that promote content creation can adversely affect humdrum innovation in markets for copyright works. This is not restricted to marginal substitution of alternative investments, but roots in the costs of trading rights, informational problems and market power. In our analysis, returns on some types of humdrum innovation will virtually always decrease with greater copyright protection.

The empirical example studies the relative weight of innovation benefits and innovation costs of copyright for a particular type of suppliers of copyright works. The main novelty is that both content creation and humdrum innovations are included into the assessment. At the time of the survey, the small German record companies surveyed reported that the need to clear copyrights seems to obstruct innovation more

than unauthorized copying. These responses are very probably context specific, regarding both the time of the survey and the type of rights holders, and there are limitations to the methods employed. Nevertheless, the findings demonstrate that even rights holders can experience copyright as a restriction on innovation.

According to our analysis, this result does not necessarily imply that current copyright arrangements do not promote innovation and creativity. The results could also illustrate that firms without extensive copyright endowments – such as those surveyed here – have a lower net benefit from copyright protection than larger incumbent firms. Furthermore, the balance between the copyright system's innovation costs and benefits could change over time with changes in technological opportunities. It seems probable that there were extensive and numerous technological opportunities in the record industry at the time of the survey. In such a situation, any benefits of copyright regarding content creation are more likely to be offset by obstacles to humdrum innovation.

In principle, the main results of this paper should apply to any form of IP. Even IP systems that promote the supply of new protected ideas may inhibit other types of innovation within the same market. Considering IP as a whole, the socially desirable strength of protection is likely to change if this unintended consequence is included into the analysis. Since IP systems comprise of several scalable aspects, it may also be possible to alter specific IP arrangements in order to minimize obstacles to humdrum innovation. There is certainly great scope for further research on such unintended consequences of IP, and the issue may be of practical importance for IP policy.

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## Tables

TABLE 1: List of variables

Variable	Concept	Operationalization	Response categories (code)
CLEAR	Copyright as an innovation obstacle (clearing)	Perceived significance of factors hampering or preventing innovation in firm	Four point semantic scale between 'high' (1) and 'no obstacle at all' (4)
PIRA	Unauthorised copying as an innovation obstacle (piracy)		
AGE	Age of the firm	Year of firm foundation subtracted from year of survey	Open question, whole numbers
SIZE	Size of the firm	Number of jobs in firm in full time equivalents	Open question, whole or fraction numbers
RCOMP	Specialisation as record company	Share of record companies' core activities in total turnover	13 categories between '0%' (1) and '100%' (13)
INNO	Technical innovativeness of the firm	Number of IT-related, new technologies adopted	Sum of innovations adopted from a set list of five technologies <sup>(1)</sup>
NOV	Specialisation on novel content	Share of novelties in total sales	13 categories between '0%' (1) and '100%' (13)
NONP	Variety of content output	Number of new, full-length titles released in 2004 (playing time > 25 min.)	Open question, whole numbers

<sup>(1)</sup> The technical innovations covered were: (1) Internet presence; (2) online retailing of physical sound-carriers; (3) commercialization of downloads, streams and ringtones; (4) commercialization of novel types of sound-carriers; (5) digital rights management. The scale ranges from 0 to 5.

TABLE 2: Survey results regarding copyright related innovation obstacles

		CLEAR (%)	PIRA (%)
Frequencies (code)	High (1)	66 (14.4)	43 (9.4)
	Intermediate (2)	125 (27.4)	105 (23.0)
	Low (3)	135 (29.5)	150 (32.8)
	No obstacle (4)	131 (22.4)	159 (34.8)
	Total	457	457
Descriptives	Mean	2.72	2.93
	Median	3.00	3.00
	Mode	3	4
	Std. Deviation	1.032	.975
Percentiles	25	2	2
	50	3	3
	75	4	4

NOTE – Non-responses and responses of ‘Don’t know’ excluded

TABLE 3: Tests for significant differences between copyright related innovation obstacles (variables CLEAR and PIRA)

	Wilcoxon signed ranks	Friedman's ANOVA	$\chi^2$ -test (*)
<i>Test statistic</i>	Z=-4.301(**)	$\chi^2=18.810$	$\chi^2=8.670$
<i>p</i>	.000	.000	.003
<i>df</i>	1	1	1

\* with variables recoded into a dummy variable (“no obstacle” or “low” coded as 1; “intermediate” or “high” coded as 2); no cells have an expected count < 5, minimum expected count was 169.5; Cramer's V = .097

\*\* based on negative ranks when comparing PIRA with CLEAR

TABLE 4: Logistic regression with CLEAR as dependent variable

Predictor	$\beta$	<i>SE</i> $\beta$	Wald's $\chi^2$	<i>df</i>	<i>p</i>	$e^\beta$ (odds ratio)
Constant	-.201	.535	.141	1	.708	.818
AGE	-.053(*)	.023	5.572	1	.018	.948
SIZE	-.072	.061	1.406	1	.236	.930
RCOMP	-.017	.035	.246	1	.620	.983
INNO	.188	.114	2.709	1	.100	1.207
NOV	.000	.032	.000	1	.994	1.000
NONP	-.001	.002	.239	1	.625	.999

NOTES – CLEAR recoded into a dummy variable (“no obstacle” or “low” coded as 1; “intermediate” or “high” coded as 2); n = 284 with no missing values; model  $\chi^2 = 13.918$  (p=.031); Hosmer and Lemeshow  $\chi^2 = 9.896$  (p=.272); Cox and Snell  $R^2 = .048$ ; Nagelkerke  $R^2 = .065$

\* significant at the .05-level

TABLE 5: Logistic regression with PIRA as dependent variable

Predictor	$\beta$	<i>SE</i> $\beta$	Wald's $\chi^2$	<i>df</i>	<i>p</i>	$e^\beta$ (odds ratio)
Constant	-1.164	.527	4.883	1	.027	-1.164
AGE	-.011	.016	.473	1	.491	-.011
SIZE	-.068	.061	1.255	1	.263	.934
RCOMP	.021	.036	.336	1	.562	.021
INNO	.142	.117	1.475	1	.225	.142
NOV	.006	.033	.034	1	.854	.006
NONP	-.001	.003	.147	1	.701	-.001

NOTES – PIRA recoded into a dummy variable (“no obstacle” or “low” coded as 1; “intermediate” or “high” coded as 2); n = 288 with no missing values; model  $\chi^2 = 5.202$  (p=.518); Hosmer and Lemeshow  $\chi^2 = 15.654$  (p=.048); Cox and Snell  $R^2 = .018$ ; Nagelkerke  $R^2 = .025$ .