JENA ECONOMIC RESEARCH PAPERS

2010 – 056

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www.jenecon.de

ISSN 1864-7057

The JENA ECONOMIC RESEARCH PAPERS is a joint publication of the Friedrich Schiller University and the Max Planck Institute of Economics, Jena, Germany. For editorial correspondence please contact markus.pasche@uni-jena.de.

Impressum:

Friedrich Schiller University Jena
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D-07743 Jena
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Max Planck Institute of Economics
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D-07745 Jena
www.econ.mpg.de

Jena Economic Research Papers 2010 - 056

Vertically Related Markets of Collective Licensing of Differentiated Copyrights with Indirect Network Effects*

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August, 2010

Abstract

This paper presents a theory of vertically interrelated markets of identical fixed size under implementation of positive indirect network effects. By introducing two Salop circles, a two-sided market model is provided, where intermediaries of differentiated copyrights for intellectual property, like performing rights organizations or publishers, compete as oligopsonists for owners of the intellectual property and as oligopolists for the users of their blanket licenses. We demonstrate, that an increase in competition benefits either license users or copyright owners or harms both groups. Moreover, if license users gain from an increased market entry, the owners of the intellectual property have to incur losses and vice versa.

JEL classification: D43, L13, L44, L82

Keywords: Vertical restraints; Indirect network effects; Copyright enforcement; Performing rights organizations; Music industry

*I thank Markus Pasche and Hans-Walter Lorenz for valuable comments and suggestions.

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1 Introduction

Intellectual property can be described as *any valuable human product that has an existence separable from a unique physical embodiment* (Landes and Posner (2003)). This notion indicates a marketability of copyrights and encloses verbal or musical expressive work. In the case of music as the intellectual property, composers, songwriters or artists are copyright owners which have to be compensated if their work is used for commercial purposes. Hence, when a copyrighted song is played on the radio or on television, the copyright owner of the song is entitled to receive a compensation. In order to reduce transaction costs and to increase efficiency, performing rights organizations (PROs) hold in trust composers' copyrights by offering blanket licenses [1]. Thus, PROs can be established as intermediaries which allow for an efficient economic exchange of claims between copyright owners and the users of licenses, because it would indeed be very difficult and costly for the copyright owners to monitor all radio and TV stations and to determine whether their songs are being played or not: but also potential users of copyrights would have to face high search costs to identify the respective copyright owner of the music, they intend to broadcast.
The role of PROs became more important in recent years. Digitalization and file sharing transformed music into an informational good, which is in most cases characterized by non-excludability. Thus, digitalized music can actually be classified as a public good. Most music labels incurred severe losses caused by the widely-used peer-to-peer file sharing technology[2], while it seems that PROs benefited from this development [3]. Those major changes in the technology and business of music distribution as well as changes in the legal framework constitute a major challenge to the business model of performance rights

[1] Compare Merges (2008) for a broader discussion of the transaction cost problem.

[2] An empirical analysis concerning decreasing returns of the music industry and file sharing is provided by Rob and Waldfogel (2006). There exists a wide range of literature dealing with illegal distribution of music (see e.g. Gayer and Shy (2005) or Peitz and Waelbroeck (2006), who establish that free downloading can also cause positive effects for the business of live performances as well as it can improve the match between the customers' tastes and the characteristics of the music.)

[3] see for example Merges (2008) or The BMI Annual Review 2008 - 2009: BMI raised its royalty payments from almost 500 million Dollar in the year 2003 to 903 million Dollar in its 2009 fiscal year.

licensing.

It is often argued, that the collective administration of copyright laws is the most efficient way to license and to enforce the copyrights of owners of protected intellectual property. Due to the existence of fixed costs in the administration of copyrights, a single administrator benefits from economies of scale. This 'natural monopoly argument' is often cited in the discussion about regulation or fostering competition between performing rights organizations (see e.g. Katz (2005)). Following this argument, it is not surprising that the situation in Europe is characterized by national, factual and legal monopolistic organizations like the German GEMA. Without regulation or fostering competition, the existence of such monopolies could be socially problematic, because no price competition between the copyright owners exist, allowing PROs to exploit their market power to the disadvantage of users of performing rights. Consider for example that a respective online business model like a video platform needs a certain selection of popular music to retain listeners and therefore to generate revenues from advertising. At compiling these selection, the user of the music is dependent on the pricing policy of a monopolistic organization. Furthermore, PROs can abuse their authority by imposing burdensome conditions for their own members and by discriminating between their members implying disadvantages for composers. Recent efforts made by the European Commission[4] in order to foster competition between the PROs in the European domestic market indicates that national licensing can be considered a severe impediment to the business of digital music platforms. Abolishing the barriers of jurisdictional licensing should foster competition between the PROs in a single European market.

In contrast to the European market, the American market for performance rights licensing is characterized by oligopolistic competition. Until 1939 the ASCAP (American Society for of Composers, Authors, and Publishers) has been the first and single performing rights organization, founded as a first effort to collect fees for the public performance of music.

[4] see Reference of the Commission. Number 2005/737/EG. Further examples of competition law enforcements against PROs in several countries can be found in Katz (2005).

In the beginning popularity of radio broadcasting, ASCAP used its monopolistic market power to rise the rate for their blanket licenses from 2 percent up to 7.5 percent of the broadcasters' gross revenues (see e.g. Kleit (2000) as well as Conolly and Krueger (2005)). Due to this fact, broadcasters decided to start their own organization in order to foster competition and to break ASCAP's monopolistic tactics. In 1939, the National Association of broadcasters, in cooperation with NBC and CBS, founded its own PRO called BMI (Broadcast Music Incorporated). Today, ASCAP and BMI [5] are not-for-profit entities sharing the US market in an almost perfect duopolistic competition. With SESAC (Society of European Stage Authors & composers), a third private player operates in the market with a small market share of only 3 - 5 percent. But SESAC, in contrast to ASCAP and BMI is a for-profit company that is not owned by publishers and musicians allowing to adopt a more exclusive policy[6] (see e.g. Conolly and Krueger (2005)). Today, 201 PROs operate in 108 countries organized under the 'International Confederation of Societies of Authors and Composers'.

Following the inspiring ideas presented by Kleit (2000) and Katz (2005), we investigate a Bertrand type stylized model under implementation of two Salop-circles of fixed size, in which institutions like PROs or music publishers acting as intermediaries between the owners of copyrights (composers or artists) and the users (radio or TV stations). We introduce the idea that these intermediaries specialize in particular type of music[7]. Intermediaries compete in the acquisition and in the supply of a differentiated product for the

[5] Kleit (2001) describes the investments in BMI as a 'pure public good' because it was prohibited to BMI to exclude or discriminate any non-members as well as to implement exclusionary contractual strategies.

[6] Due to Katz (2005) the existence of SESAC could be seen as an interesting fact against the natural monopoly argument. The small market share of SESAC indicates a monopolistic market structure is not needed to license efficiently. Kleit (2000) argues that a model would be of interest where PROs like SESAC can aggressively market on one part of the product space without facing antitrust constraints like ASCAP and BMI.

[7] Kohn and Kohn (2002) argue, that it was once believed that a composer's decision to join a PRO depended to a large degree on the type of music. For example, composers of indie music was better off with BMI. Although Kohn and Kohn (2002) state that these distinctions do not exist anymore, we pick it up as inspiration for a possible setup keeping aloof from monopolistic licensing.

purpose of establishing in a certain market segment[8].

This paper contributes to the existing literature providing a formal economic analysis of performance rights licensing. In a simple theoretical framework, Besen et al. (1992) modeled PROs as copyright collectives. They showed that with open entry collective membership grows until the costs of the collective and its members equals the value of the entire repertoire of the organization. Kleit (2000) examined competition between performance rights organizations which offer blanket licenses on a Salop circle. The model assumes only one demander moving on the circular market where musicians place their songs equidistantly in a differentiated product space. Kleit (2000) also demonstrated that in a competitive duopoly blanket licenses prevail, instead of per-use licenses. In contrast to Kleit's work, we solely consider blanket licenses and assume that intermediaries specialize on certain parts of the music product space.

The paper contributes to the existing literature on competition in two-sided markets[9]. The characteristic of such a scenario is that participants on one of the market can directly profit from an increasing number of participants on the other side of the market and vice versa. Both groups of participants are typically intermediated by platforms which compete for customers on both sides.

The model provided in this paper can be described as a vertically integrated market, where musicians and composers first offer an input in the form of the copyright of their music, PROs collect these inputs and bundle them to a blanket license which they offer on an output market. Some recent papers contributed to the research of considering interrelated markets in a framework of spatial competition. Alexandrov et al. (2008) develop a vertically related market model of spatial Bertrand competition with two circular markets, where intermediaries compete for suppliers on an input market and for customers on an output market. In contrast to our work, the paper focuses only on situations where either

[8] Note that music can not only be differentiated by genre but also by the degree of popularity.

[9] The notion two-sided markets was introduced by Rochet and Tirole (2003) and applied to several industries like advertising on media platforms (see e.g. Armstrong (2006)).

more suppliers than customers or more customers than suppliers operate in the market. By varying the circumference of the respective circular market, they create a framework where intermediaries are either monopsonists or oligopsonists on the input market and always local monopolists on the output market.

Reisinger and Schnitzer (2009) construct a model of vertical relation considering oligopolistic competition on an upstream and a downstream market by using two interrelated circular markets. By implementing a successive approach, upstream firms must set their prices under uncertainty of the demand of the downstream firms. In this framework downstream conditions dominate the standard Salop model and regulation of the downstream market is welfare enhancing if the number of upstream and downstream firms is relatively small.

The present paper is primarily related to the work of Dewenter et al. (2009) who investigated a horizontal interrelation between a market for music recordings and concert tickets. By introducing indirect network effects they showed that prices in both markets are corrected downwards compared to the standard Salop model and that file sharing can have ambiguous effects on the particular parameter values. The following section sets out the model.

2 Model Setup

The following model introduces intermediaries of copyrights, for example in the form of PROs or music publishers, which allows for an economic efficient intermediation between owners and users of copyrighted work by considering positive indirect network effects and a differentiated measure of preferences for the respective copyrighted work (e.g. musical genre or the degree of musical mainstream appeal).

A discrete number of copyright owners like artists and composers and license customers like radio stations is uniformly distributed on two respective Salop-circles with a normalized circumference of one. Both circles are interrelated by the PROs, which act as intermediaries between the two circular cities. This means that the PROs provide the service of enforcing copyrights of artists and composers and that they compete for these copyrights as oligopsonists on the first circular market. The affiliated copyrights are

pooled into a blanket license which is used to compete in an oligopolistic manner for potential license customers on the second circular market.

The PROs are equidistantly and symmetrically distributed between both circles. Thus, they are located at the same position on both circles. We assume that the intermediaries solely sell blanket licenses to the license customers containing their entire repertoire, which is determined by their market share within the group of artists and composers. Hence, the segmental market share within the group of license customers of a respective intermediary PRO exactly corresponds to its segmental market share within the group of copyright owners. *Figure 1* plots this situation graphically.

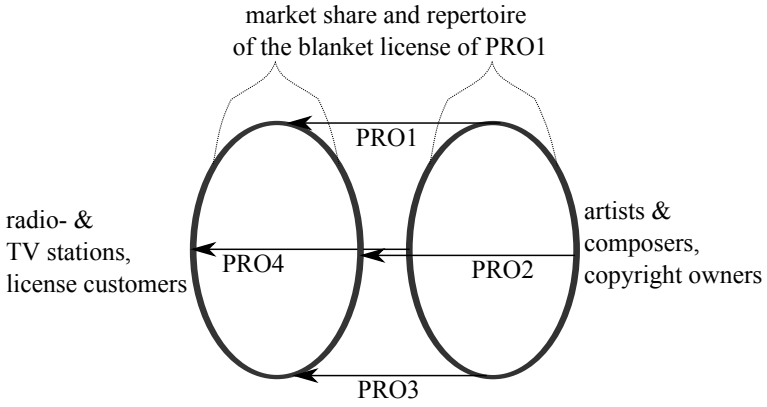

Figure 1: Two vertically interrelated Salop-circles with $N = 4$ PROs

We assume copyright owners to receive a monetary benefit by the royalty payments of the respective PRO which is financed by the price charged for the blanket license[10]. Indirect network effects play an important role in the licensing of performance rights. Artists or composers can gain a lot from indirect network effects from being affiliated with a PRO. The intuition behind this scenario is simple. Imagine a radio station which buys a blanket license containing a song of a respective artist. This radio station can play the song as

[10] Note, that copyright owners do not have the outside option of single transactions with potential license customers as well as the license user does not have another alternative as to buy a blanket license if she wants to use a copyrighted work.

often as it wants which increases the chance for the artist to be played on air and thus to gain in popularity. By imputing an interrelation between the frequency of a song being played on air and record sales, a positive network externality could be introduced [11]. Thus, a copyright owner is interested in being affiliated with a PRO which has a large market share within the group of license users. On the license users' circular market, positive indirect network effects play a similarly important role. A respective TV or radio station gains more utility from a blanket license containing a larger repertoire of musical diversity. Thus, the existence of indirect positive network effects is directly caused by the importance of economies of scope in the licensing of performing rights.

As in all models of spatial competition, every copyright owner and license customer faces so called 'transportation costs' per unit of distance. These 'transport costs' are just a synonym for the degree of preference differentiation between the respective agents on both circles and thus for the horizontal differentiation of the respective product like music. Remember that a license user is located on a certain position on the circular market. If the position of this respective user is not conform with the location of the intermediary on the circle, the customer will not get a license fitting best to his preferences. It follows, that the customer has to make compromises by moving towards the next PRO. The same situation is valid for copyright owners. Note, that PROs are mostly copyright collectives which are often founded by composers. By not completely abolishing the 'copyright collective idea' one can assume that the raisers of a PRO are located on a certain position, while other composers have to make compromises, here a decrease in the gross utility amounting to the transportation costs, to get affiliated with the respective PRO[12].

The intermediary PROs compete on both markets in a 'one shot game' by setting their

[11] Peitz and Waelbroeck (2005) cite a survey according to which the radio is seen as the most important type of media which influenced US consumers' buying decision of their last CD.

[12] This could also be a monetary loss caused by 'royalty discrimination'. Many PROs pay different royalties to their members according to their success and thus according to their degree of musical differentiation. It is well known that the German GEMA makes a difference in royalty payments between full members and other members.

royalties and prices for the blanket licenses simultaneously [13]. In the next section thereafter a model which specifies the oligopolistic competition between the intermediary PROs is provided.

3 Oligopolistic Competition Between Intermediaries of Intellectual Property Rights Licenses

We assume that every right owner offers only one copyrighted song or album, while we make the restrictive assumption that license users only buy one blanket license that covers the entire repertoire of an intermediary and that fits best to their preferences (here: their position on the circular market)[14]. A discrete number of copyright owners $k = 1, ..., n$ and customers $i = 1, ..., m$ are uniformly distributed on their respective circular markets. The $j = 1, ..., N$ intermediary PROs, which interrelate the two markets, are equidistantly distributed on both circles. Consider a respective PRO j which is located at the identical position x_j and q_j somewhere on both circular markets. Assume now a given copyright owner who is located at position q_k on her circular market which is to the right of q_j. Thus, the utility of this copyright owner depends negatively on the distance $|q_j - q_k|$, which means that the copyright owner has to make compromises and to approach PRO j to get affiliated with it. The degree of this disutility is measured by the transportation cost parameter τ. Equivalently, a given license user at position x_i, with $x_i \neq x_j$, knows that she has to approach PRO j at a transportation cost parameter t and to buy a blanket license which does not perfectly coincide with her preferences. Thus, a respective copyright owner k and license user i receive the following utility from making a deal with PRO j:

$$U_k = V + w^j + \theta x^j - \tau \left| q_j - q_k \right|, \tag{1}$$

[13] As Kleit(2000) mentioned, the realistic game in such a framework is more dynamic, rather than occurring at one time.

[14] Following Armstrong (2006), license users are 'single homing'.

and

$$U_i = R + \lambda q^j - t\,|x_j - x_i| - p^j \tag{2}$$

where R specifies the license customer's reservation utility of buying her ideal blanket license which is defined as a license obtained from a PRO which is located at the identical position on the circle. A given PRO j charges a price p^j for its blanket license. Copyright owners have a gross utility V of being affiliated with an intermediary[15] and receive a positive monetary fixed royalty w^j from intermediary j[16]. Note that a buyer of a blanket license, for example a radio station, uses the license to attract listeners and thus to gain in popularity and it is obvious that an increase in popularity makes it easier to generate higher amounts of advertising revenues. By assuming that an increased variety covered by the blanket license is more attractive for listeners, an increase of the repertoire of the blanket license from a respective PRO j, which is determined by the segmental market share of PRO j within the group of copyright owners q^j, enhances the utility of a respective buyer of this blanket license. The scaling parameter λ measures the beneficial influence of q^j on U_i. Vice versa, a given copyright owner benefits from an increasing segmental market share x^j of the PRO j within the group of license customers. This increase in utility is measured by the scaling parameter θ.

As already mentioned, PROs are characterized by equidistant locations on the circular market in order to niche the market of the differentiated product music. From the assumption that copyright holders as well as license users are uniformly distributed on their respective circle, each pair of adjacent PROs $(j, j+1)$ is observed by an equal share $1/N$ of copyright holders and license customers.

The market segment of PRO j within the group of license users x^j can be derived by the standard Salop approach. The license customer who is indifferent between PRO j and

[15] The gross utility V is assumed to be large enough to ensure that all copyright owners are affiliated with a PRO.

[16] Note that we do not consider any discrimination policies concerning royalties and prices.

PRO $j+1$ determines the market segment x^j. This marginal customer is located at a distance of $\widehat{x}$ to the right of PRO j. By assuming PRO $j+1$ to have a market share of $\widetilde{q}$ within the group of license owners and to ask for a price $\widetilde{p}$, we can equate the utility functions of the indifferent license customer $\widehat{x}$ and thus we have

$$R + \lambda q^j - t\widehat{x} - p^j = R + \lambda\widetilde{q} - t\left(\frac{1}{N} - \widehat{x}\right) - \widetilde{p}. \tag{3}$$

Solving for $\widehat{x}$ yields the location of the marginal license demander. According to the symmetric structure of the model, $\widehat{x}$ also determines the marginal customer on the left side from j who is indifferent between the blanket license of PRO $j-1$ and PRO j. Hence, doubling $\widehat{x}$ yields the PRO's market share x^j within the group of license customers, which is just the length of the distance on the circle between the two marginal customers $\widehat{x}_{j-1}$ and $\widehat{x}_{j+1}$:

$$x^j = 2\widehat{x} = \frac{\lambda(q^j - \widetilde{q}) + (\widetilde{p} - p^j)}{t} + \frac{1}{N}. \tag{4}$$

To comply with the requirements of offering a blanket license, intermediary j has to pool the respective copyrights from those copyright owners who can reach a positive utility from getting affiliated with PRO j. Therefore, we have to derive the position $\widehat{q}$ of the marginal right owner, who is indifferent between being affiliated with intermediary j or its respective neighboring PRO $j+1$, which offers royalty $\widetilde{w}$ and serves a market segment $\widetilde{x}$ within the group of license users. Hence, we have

$$V + w^j + \theta x^j - \tau\widehat{q} = V + \widetilde{w} + \theta\widetilde{x} - \tau\left(\frac{1}{N} - \widehat{q}\right). \tag{5}$$

In the same way as deriving the market segment within the group of license customers, solving for $\widehat{q}$ determines the position of the marginal copyright owner. Doubling $\widehat{q}$ let us derive the variety of copyrighted music q^j which an be pooled to a license by PRO j as a

segment of the circular market, namely the distance between $\widehat{q}_{j-1}$ and $\widehat{q}_{j+1}$:

$$q^j = 2\widehat{q} = \frac{\theta(x^j - \widetilde{x}) + (w^j - \widetilde{w})}{\tau} + \frac{1}{N}. \tag{6}$$

Due to the positive indirect network effects, the market segment q^j depends to a degree of θ on the difference between PRO j's own market share and the market share $\widetilde{x}$ of its adjacent competitors within the group of license customers. Equivalently, the market share x^j within the group of license customers depends to a degree of λ on the difference between q^j and the market segment $\widetilde{q}$ of the adjacent competitors within the group of copyright owners.

By considering these interdependencies we want to reformulate (4) and (6) with respect to prices and royalties. Following Armstrong (2006), we substitute the respective market segments into each other to derive expressions depending solely on prices and royalties.

The market segments within the group of license customers as well as copyright owners of the adjacent competitors of PRO j, namely $\widetilde{x}$ and $\widetilde{q}$ are given by $\widetilde{x} = 2\left(\frac{1}{N} - \frac{x^j}{2}\right)$ and $\widetilde{q} = 2\left(\frac{1}{N} - \frac{q^j}{2}\right)$[17]. Thus, the reformulated market shares can be presented as

$$x^j(w^j, p^j) = \frac{\tau(p^j - \widetilde{p}) + 2\lambda(\widetilde{w} - w^j)}{4\lambda\theta - t\tau} + \frac{1}{N} \tag{7}$$

and

$$q^j(w^j, p^j) = \frac{2\theta(p^j - \widetilde{p}) + t(\widetilde{w} - w^j)}{4\lambda\theta - t\tau} + \frac{1}{N}. \tag{8}$$

[17] Note, that the next competitor $j+1$ of PRO j is located at a distance of $\frac{1}{N}$ to the right of PRO j. Thus, $j+1$ covers a part of the distance between j and $j+1$, which is given by $\widehat{x}^{j+1} = \frac{1}{N} - \widehat{x^j}$. According to the symmetric market structure we know that $\widetilde{x} = 2\widehat{x}^{j+1}$. The adjacent PRO's market segment $\widetilde{q}$ within the group of copyright owners can be derived equivalently.

By using these market segments we formulate the profit function π^j. To derive the revenues of PRO j, $x^j(w^j, p^j)$ has to be multiplied with the number of license customers m in the market and the respective equilibrium price p^j. Simultaneously, variable costs which are given by the royalties w^j multiplied with the segmental market share within the group of copyright owners $q^j(w^j, p^j)$ and the number of owners n in the market have to be considered. Hence, the profit function is given by

$$\begin{aligned}\pi^j = p^j m \left(\frac{\tau(p^j - \widetilde{p}) + 2\lambda(\widetilde{w} - w^j)}{4\lambda\theta - t\tau} + \frac{1}{N} \right) \\ - n w^j \left(\frac{2\theta(p^j - \widetilde{p}) + t(\widetilde{w} - w^j)}{4\lambda\theta - t\tau} + \frac{1}{N} \right) - F.\end{aligned} \tag{9}$$

At least, every intermediary faces a fixed set-up cost F, when it decides to enter the market. Such costs can also contain losses emerging from bargaining with copyright owners and potential customers[18]. To ensure the existence of an equilibrium, we have to impose the following restriction on the parameter values that ensures concavity of the profit function in prices and royalties [19].

Assumption 1. *To obtain the equilibrium prices and royalties from the first-order conditions, we have to impose the following restriction:*

$$mnt\tau > (m\lambda + n\theta)^2. \tag{10}$$

[18] Note that negotiation costs became more important in the German market for performance rights licensing since a reformation of the copyright law forces the German GEMA to negotiate with the collectives for digital storage media. Before 2008, the charges for PCs or DVD writers were prescribed by law (see 'Zweites Gesetz zur Regelung des Urheberrechts in der Informationsgesellschaft vom 26. Oktober 2007, § 13a'. A corresponding elaboration can be found in Hucko (2007)). Similar conclusions can be drawn from the actually failed negotiations between the GEMA and the online video platform Youtube.

[19] Similar restrictions were implemented by Armstrong (2006) and Dewenter et al. (2009).

A detailed derivation is provided in the Appendix.

The optimal price p^j set by intermediary j in equilibrium and the corresponding royalty w^j can be obtained from the first order conditions of maximizing(9):

$$p^j = \frac{\widetilde{p}}{2} + \frac{\lambda(w^j - \widetilde{w})}{\tau} - \frac{(t\tau - 4\theta\lambda)}{2N\tau} + \frac{n\theta w^j}{2m\tau} \tag{11}$$

and

$$w^j = \frac{\widetilde{w}}{2} + \frac{\theta(p^j - \widetilde{p})}{t} - \frac{(4\lambda\theta - t\tau)}{2Nt} + \frac{m\lambda p^j}{2nt}. \tag{12}$$

A price p^{j*} and a royalty w^{j*} is a Nash equilibrium if for all $j \in N$, $\pi^j(p^{j*}, \widetilde{p}, w^{j*}, \widetilde{w}) \geq \pi^j(\forall p^j, \widetilde{p}, \forall w^j, \widetilde{w})$, meaning that PRO j chooses its best price and royalty, given that all other competitors hold their prices and royalties constant. According to the equidistant locations of the PROs on both circular markets, all competitors are assumed to charge identical prices and pay identical royalties. Solving (11) and (12) for the symmetric Nash equilibrium prices $p^* = p^j = \widetilde{p}$ and royalties $w^* = w^j = \widetilde{w}$ yields

$$p^* = \frac{t}{N} + \frac{2\theta}{\tau}\left(\frac{w^* n}{m} - \frac{2\lambda}{N}\right) \tag{13}$$

and

$$w^* = \frac{2\lambda}{t}\left(\frac{p^* m}{n} + \frac{2\theta}{N}\right) - \frac{\tau}{N}. \tag{14}$$

The equilibrium price and royalty equations are mutually linearly dependent with $\frac{\partial p^*}{\partial w^*} > 0$ and $\frac{\partial w^*}{\partial p^*} > 0$.

From equation (7) and (8), it apparently follows that the symmetric Nash equilibrium market segments q^{j*} and x^{j*} are given by $\frac{1}{N}$. Thus, the marginal copyright owners as well

as the marginal license users are located in the middle of the segment between PRO j and its respective neighbors.

4 Market Entry

In this section we investigate the market entry under a symmetric zero-profit Nash equilibrium. Thus, intermediaries enter the market until their profit equals their fixed set-up costs F.

Before investigating market entry conditions, we can rewrite the equilibrium royalty w^* and the equilibrium price p^* by considering the two-way interdependencies between them:

$$p^* = \frac{mt - 2n\theta}{mN} \tag{15}$$

and

$$w^* = \frac{2m\lambda - n\tau}{nN}. \tag{16}$$

From (15), it follows that with increasing transportation costs for users, the price p^*, an intermediary can impose in equilibrium, increases. By contrast, an increasing transportation cost parameter τ let the royalty w^* an intermediary offers in equilibrium, decrease. These countervailing effects can be explained by the fact that a higher degree of transportation costs makes it more cost-intensive to switch to one of the intermediary's neighbors. Thus, the willingness to pay of a potential demander for a blanket license is higher, while the PRO can pay less to the copyright owners without being worried about their switching to one of its neighbors. The influence of an increasing network effect works in a similar way. An increasing number of customers m as well as an increasing influence λ of the blanket license's segmental size q^j on their utility, increases the equilibrium royalty. Of course, the more important q^j is for license customers, the higher must be w^* in order to affiliate with more copyright owners, which makes it more attractive for license users to buy a license

from PRO j. For the group of license users, an increasing number of copyright holders n combined with an increasing network parameter θ lowers the price, a respective PRO can impose for its blanket license. These results are due to the aggressive competition between the intermediary PROs in the present framework. Every PRO offers the highest possible royalty and the lowest possible price to affiliate with as many customers and owners as possible, driving its profits to zero.

Note that we have to consider a business stealing effect caused by the fixed market sizes. Thus, a potential new market entrant has to steel a part of the business from the incumbent PROs in order to niche the circular music market[20].

The countervailing effects of the transportation costs and the network effects make it inevitable to impose additional restrictions on the parameter values.

First, in order to ensure positive royalties, we have to impose an additional restrictive assumption on the parameter values τ and λ [21]. From (16) we can derive that $2m\lambda$ must exceed $n\tau$. By considering this restriction, a higher degree of competition lets the royalties decrease [22]. Of course, the effect of a variation of the number of market entrants on the equilibrium price is identical. It follows from (15), that $tm > 2n\theta$ is needed to ensure $p^* > 0$. By considering this restriction, it is easy to see that $\frac{\partial p^*}{\partial N} = \frac{-(tm-2\theta n)}{(mN^2)}$ is strictly negative. These results are intuitive. A higher degree of competition for license users forces the PROs to cut prices for their blanket licenses. From (14), decreasing prices restrict them to pay higher royalties in the competition for copyright holders.

We observe that our model requires certain restrictive boundaries concerning the relation between users and owners $\frac{m}{n}$ and the respective transportation cost and network param-

[20] As Spence (1976) already stated, a new market entrant causes the pie to be sliced in more pieces. But in the case at hand, the pie does not expand. A model with a flexible size of the interrelated circular markets can lead to monopolistic competition on one side of the market. Such a model is provided by Alexandrov et al. (2008).

[21] Note, that we do not consider 'negative royalties', which could be possible if the gain in utility for the license holders caused by an the network effects is of such importance that they are willing to pay to get affiliated with a respective PRO.

[22] Note that $\frac{\partial w^*}{\partial N} = -\frac{2m\lambda - n\tau}{nN^2}$. By considering the restriction $2m\lambda > n\tau$ it follows that $\frac{\partial w^*}{\partial N}$ is strictly negative.

eters.

Hence, the smaller the influence of the PROs' market segment within the group of copyright owners, measured by λ, on the utility of the license users compared with the transportation costs of the copyright owners τ, the higher must be the user-to-owner relation $\frac{m}{n}$. This result is also intuitive. Note that if the positive influence of the PROs' market segment within the copyright owners on the users' utility is relatively low. It is obvious that the users' willingness to pay for a blanket license also tends to be smaller. It follows, that the number of users compared to the number of owners within the PROs' bilateral market segment must be relatively large, to let the PROs pay a positive royalty considering a given transportation cost parameter τ. The associated welfare implications concerning the restrictions of the relation $\frac{m}{n}$ are presented in the section thereafter.

By inserting the equilibrium prices and royalties from equation (15) and (16) as well as the symmetric Nash equilibrium market segments $\frac{1}{N}$, we can rewrite the profit function as

$$\pi^*(N) = \frac{m}{N}\left(\frac{mt - 2n\theta}{mN}\right) - \frac{n}{N}\left(\frac{2m\lambda - n\tau}{nN}\right) - F. \tag{17}$$

Given our assumptions concerning the parameter values, it can be shown that (17) strictly decreases with N. In the symmetric zero-profit Nash equilibrium, market entry is endogenously determined. Intermediaries enter the market until their profits vanish. Solving the profit function $\pi^* = 0$ for N yields the endogenously determined variety of market entrants N^C with free entry:

$$N^C = \frac{\sqrt{m(t - 2\lambda) + n(\tau - 2\theta)}}{\sqrt{F}}. \tag{18}$$

We observe that a higher degree of preference differentiation t and τ increases the diversity of intermediaries, while stronger complementary effects λ and θ reduce market penetration. Inserting N^C in equation (15) and (16) yields the equilibrium prices $p^* = \frac{\sqrt{F}(mt-2n\theta)}{m\sqrt{m(t-2\lambda)+n(\tau-2\theta)}}$ and royalties $w^* = \frac{\sqrt{F}(2m\lambda-n\tau)}{n\sqrt{m(t-2\lambda)+n(\tau-2\theta)}}$. Increasing fixed set-up

costs F cause an increase in equilibrium prices as well as an increase in equilibrium royalties. Thus, increasing fixed set-up costs lower market entrance in equilibrium ($\frac{\partial N^C}{\partial F} < 0$), as is always the case in Salop models with free entry.

These results are comparable to the model with horizontally related markets by Dewenter et al. (2009). By contrast, and due to vertically related markets, royalties can be understood as intermediary PROs variable costs, which increase with a higher degree of the influence of the repertoire of the blanket license for customers and decrease with an increasing preference differentiation of copyright owners.

5 Welfare Aspects

Within this framework welfare consists of three parts: the surplus of the copyright owners, the surplus of the license customers and finally the aggregate surplus of the intermediaries. Consider now a benevolent social planner who regulates the number of market entrants under the assumption of a fully covered market[23]. This section should investigate the implications of an increase of competition between intermediaries for the aggregate surplus of the copyright owners as well as for the aggregate surplus of the license users.

Proposition 1: *Whether the aggregated owner and user surplus increases or decreases with a higher market penetration of PROs depends on the relation between the proportion of m to n and the proportion of the two network parameters θ and λ. The aggregated user surplus increases with an increasing number of market entrants if $\frac{m}{n} < \frac{\theta}{2\lambda}$ and decreases with a higher N if $\frac{m}{n} > \frac{\theta}{2\lambda}$. An increase or a decrease in the aggregated owner surplus depends on whether $\frac{m}{n} > \frac{2\theta}{\lambda}$ or $\frac{m}{n} < \frac{2\theta}{\lambda}$.*

[23] We assume this planner only to have the ability to impose barriers to potential new market entrants by e.g. charging an additional 'market-entry tax'. Recent papers (see Aghion and Schankerman (2004) or Reisinger and Schnitzer (2009)) investigated a social planner who can positively stimulate the welfare by a reduction in the transportation cost parameter.

Proof. By using (1), the aggregated surplus function for the copyright owners can be formulated as

$$\text{OS} = \; N\left(\frac{n}{N}\left(V+\left(\frac{2m\lambda - n\tau}{nN}\right)\right)\right) + \; N\frac{n\theta}{N}\left(\frac{1}{N}\right) - 2Nn\int_0^{\frac{1}{2N}} \tau q \; \mathrm{d}q, \qquad (19)$$

which can be transformed to

$$\text{OS} = nV + \frac{4(2m\lambda + n\theta) - 5n\tau}{4N}. \qquad (20)$$

As already mentioned, a higher degree of λ let the royalties increase, while an increasing θ enhances the copyright owners' utility of being affiliated with an intermediary. And of course, increasing transportation costs τ lower the aggregated owners' surplus [24]. From (20) it follows that an increase in N let OS increase if $\frac{m}{n} < \frac{(5\tau - 4\theta)}{8\lambda}$. From (15) we know that PROs are restricted to offer positive royalties, therefore the relation $\frac{m}{n} > \frac{\tau}{2\lambda}$ must hold and we have that $10m\lambda$ must be larger than $5n\tau$. By considering this restriction, it can be shown that (20) increases with an increasing N if $4n\theta < 2m\lambda$ and therefore if $\frac{m}{n} > \frac{2\theta}{\lambda}$. It is straightforward that OS decreases with an increase in N if $\frac{m}{n} > \frac{(5\tau - 4\theta)}{8\lambda}$ and thus if $\frac{m}{n} < \frac{2\theta}{\lambda}$.

By considering (2), the aggregated surplus function of the license users is given by

$$\text{US} = N\left(\frac{m}{N}\left(R - \left(\frac{mt - 2n\theta}{mN}\right)\right)\right) + N\frac{m\lambda}{N}\left(\frac{1}{N}\right) - 2Nm\int_0^{\frac{1}{2N}} tx \; \mathrm{d}x \qquad (21)$$

which can be reformulated as

[24] Note, as is in the standard Salop model, owners and users travel an average distance of $1/4N$ on their respective circular market at corresponding transportation costs τ and t.

$$\text{US} = mR + \frac{4(m\lambda + 2n\theta) - 5mt}{4N}. \tag{22}$$

We already proved that an increase in competition lowers the price for blanket licenses, resulting in a positive effect on the license users' aggregate surplus. Furthermore, an increasing variety of market entrants lowers the license users' average transportation costs. Equivalently to the circular market of the copyright owners, we have to consider the positive indirect network effects and, of course, a lower market share caused by the business stealing effect under fixed market size of increasing competition has a negative influence on the license users' utility[25].

From (22) it is obvious that US increases with an increase in N if $\frac{m}{n} > \frac{8\theta}{5t-4\lambda}$. From the price equation (15) we know that the equilibrium prices for blanket licenses must be positive. This is ensured if the restriction $\frac{m}{n} > \frac{2\theta}{t}$ holds. From this relation it follows that $5mt$ must be larger than $10n\theta$ and thus, US increases with a higher number of N if $\frac{m}{n} < \frac{\theta}{2\lambda}$. By contrast, US decreases with a higher market penetration of PROs if $\frac{m}{n} < \frac{8\theta}{5t-4\lambda}$ and therefore if $\frac{m}{n} > \frac{\theta}{2\lambda}$.

Q.e.d.

Figure 2 distinguishes graphically the regions, in which the aggregated user surplus as well as the aggregated owner surplus increase or decrease with an increasing competition between the intermediaries. The lower linearly increasing curve $\frac{m}{n} = \frac{\theta}{2\lambda}$ determines whether $\frac{\partial US}{\partial N} < 0$ or $\frac{\partial US}{\partial N} > 0$. The upper steeper linear curve, which is given by $\frac{m}{n} = \frac{2\theta}{\lambda}$ determines whether $\frac{\partial OS}{\partial N} > 0$ or $\frac{\partial OS}{\partial N} < 0$.

In *Figure 2* we can differentiate between three regions, which are indicated with A, B and C. Region A is characterized by a small ratio $\frac{\theta}{\lambda}$. Thus, the positive network

[25] Note, that we assume linearity of the network effect as it is assumed in the majority of the literature. Pollock (2009) showed that in a general non-linear case, welfare effects of a change in network sizes crucially depends on the degree of diminishing returns in the network effects function.

externality of a PRO's segmental market share within the group of license users on the utility function of the copyright owners is relatively small compared to the influence of this PRO's segmental market share within the group of copyright owners on the utility of the license users. Furthermore, a larger relation $\frac{m}{n}$ can be observed in region A. By considering the foregone discussion, copyright owners must face relatively high aggregate transportation costs. It follows, that as long as the transportation cost parameters fulfill *assumption 1*, copyright owners can benefit from an increase in competition while license users face a utility loss. Thus, a potential social planner would have to decide if she wants to enhance the owners' aggregate surplus by incurring welfare losses for license users.

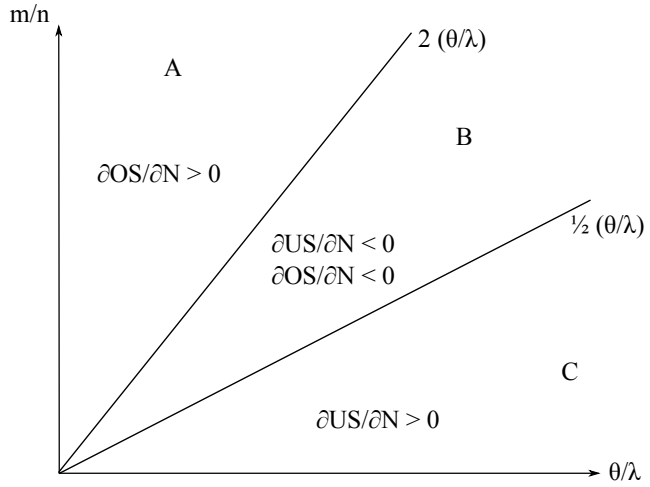

Figure 2: Aggregated customer and owner surplus with respect to $\frac{m}{n}$ and $\frac{\theta}{\lambda}$.

Consider now an increase in $\frac{\theta}{\lambda}$ and/or a small decrease in $\frac{m}{n}$ and we move towards region B where $\frac{2\theta}{\lambda} > \frac{m}{n} > \frac{\theta}{2\lambda}$. In region B we can observe that the ratio $\frac{m}{n}$ as well as the ratio $\frac{\theta}{\lambda}$ are more balanced. Under this scenario, indirect network effects play a more important role for users as well as for owners and an increase in the number of market entrants N lowers the aggregate surplus of both groups. Of course, a monopolistic market structure would maximize the welfare of users and owners.

Region C tends to come with a smaller ratio $\frac{m}{n}$ and a larger ratio $\frac{\theta}{\lambda}$. The variety of copyright owners in the market is relatively large as well as the positive indirect network effect of the PROs' segmental market shares within the group of copyright owners is

of lower importance for the license users. Thus, license users' losses from transportation costs exceed the benefits from the indirect network effects[26] and if *assumption 1* is fulfilled, license users can gain from an increase in competition. Again, as is in region A, fostering competition enhances only the aggregated surplus of one side of the market while the other side incurs losses. But in contrast to region A, stimulating competition enhances the users' welfare while copyright owners have to face losses.

We see, that within this framework an increase in competition never generates coexistent benefits for users and owners. Moreover, if $\frac{m}{n} \in [\frac{\theta}{2\lambda}, \frac{2\theta}{\lambda}]$ it follows, that an increased market entry always lowers the aggregated customer surplus as well as the aggregated owner surplus and thus, a monopolistic market setup is welfare optimal.

6 Aggregate Surplus Optimal Market Entry

To derive the aggregate surplus optimal number of market entrants N^W we have to sum the individual aggregate surplus functions to an overall aggregate surplus function Ω, which is given by[27].

$$\begin{aligned}\Omega = N\left(\frac{m}{N}\left(\frac{mt-2n\theta}{mN}\right)-\frac{n}{N}\left(\frac{2m\lambda-n\tau}{nN}\right)-\ F\right)\\ +N\left(\frac{n}{N}\left(V+\left(\frac{2m\lambda-n\tau}{nN}\right)\right)\right)+N\frac{n\theta}{N}\left(\frac{1}{N}\right)-2Nn\int_0^{\frac{1}{2N}}\tau q\ \mathrm{d}q\\ +N\left(\frac{m}{N}\left(R-\left(\frac{mt-n\theta}{mN}\right)\right)\right)+N\frac{m\lambda}{N}\left(\frac{1}{N}\right)-2Nm\int_0^{\frac{1}{2N}}\ tx\ \mathrm{d}x\end{aligned} \tag{23}$$

[26] We can say that license users rather prefer a good valued license, covering only a particular segment of the circular market, which perfectly fits to their preference instead of a license which covers a wide range of music.

[27] We have to refer to the doubtful meaning of a cardinally measured aggregate surplus function. But by considering the parameter restrictions, this let us apply comparative statics to make it possible to derive results from the model.

which can be transformed to

$$\Omega = (mR + nV - FN) + \frac{4(m\lambda + 2n\theta) - mt - n\tau}{4N}. \tag{24}$$

Maximizing Ω with respect to N yields the aggregate surplus optimal number of market entrants

$$N^W = \frac{\sqrt{m(t - 4\lambda) + n(\tau - 4\theta)}}{2\sqrt{F}}. \tag{25}$$

It is obvious and conform to the previous discussion, that the aggregate surplus optimal number of market entrants increases with a higher degree of transportation cost, while an increasing importance of the network parameters λ and θ lowers the aggregate surplus optimal number of PROs.

Note, that in this setup of vertically related markets, social welfare is maximized when the average losses caused by transportation costs $\frac{1}{4N}(mt + n\tau)$ less the extra surplus from the benefits of the indirect network effects $\frac{1}{N}(n\theta + m\lambda)$ equals the accumulated fixed costs NF of all market entrants. From (25) we can see that this is exactly the case if $FN = \frac{1}{4N}(mt + n\tau - 4(n\theta + m\lambda))$. By considering the previous discussion, we can neither determine a robust result whether an increase in competition enhances or lowers the aggregate overall surplus nor whether the social optimal level of market entry is below the free-entry equilirium level[28]. It depends inevitably on the distribution of the preferences of the copyright owners as well as on those of the customers of a blanket license and therefore on the calibration of the parameters and of course on the ratio between customers

[28] The standard result in the literature without positive network externalities is that without entry restraints social excessive entry occurs (see: e. g. Salop (1979)). By contrast, Ghosh and Morita (2007) showed in a vertically related Cournot model with a homogeneous product that insufficient entry can occur if the firms on the upstream market have too much power. Furthermore, Gu and Wenzel (2008) stated, that insufficient entry can prevail if the demand elasticity excesses a certain threshold.

and owners in the market. But by considering all assumptions this framework might be appropriate to understand models in which intermediaries compete as oligopsonists on a market for inputs and as oligopolists on a market for outputs if vertically related market segments of differentiated products with identical size are considered.

7 Conclusion

This paper provides a model of oligopolistic and oligopsonistic competition between intermediaries of copyrights for intellectual property in vertically integrated two-sided markets like performing rights organizations. By using two interrelated Salop circles of fixed size, we introduce positive indirect network effects from the copyright owner market to the license user market and vice versa.

Intermediaries compete as oligopsonists for copyright owners like composers or artist. The affiliated repertoire of copyrights is pooled into a blanket license. Using these blanket licenses, intermediaries compete as oligopolists for potential license customers. Based on the aggressive competition and the symmetric market structure in the resulting Nash equilibrium, we demonstrated that prices for blanket licenses depend on the number of copyright owners in the market as well as on the parameter which determines the intensity of the positive indirect network effect for copyright owners. The same applies to the equilibrium royalties, which need a certain number of customers as well as a certain level of the parameter which determines the intensity of the positive network externality for the license users to be positive.

Investigating welfare effects, we derive the result that users of a license and copyright owners never benefit simultaneously from an increase in competition between the intermediaries. Moreover, if an increase in competition benefits license users, copyright owners have to incur losses and vice versa. Beyond that, both, users and owners lose from a liberalization of market entry if the ratio between the number of users and owners as well as the ratio between the two network parameters are relatively balanced.

As mentioned above, the European Commission is taking initiative to foster competition between the European performing rights organizations. By assuming the scenario that

performing rights organizations niche in bounded market segments, the implications of our theoretical model let us suppose that abolishing the monopolistic market structure always harms either the owners of the intellectual property or the license users. However, even it is intended to improve the license users' surplus, the degree of preference differentiation as well as the intensity of the network parameters and the number of market participants must meet certain criteria. Thus, considering positive indirect network externalities let us not find a robust conclusion whether excessive entry occurs as a consequence of a liberalization of market entry restraints.

This paper contributes to the existing literature which deals with vertically related two-sided markets and spatial competition. Although we made some restrictive assumptions concerning the model, it can be helpful to understand the importance of positive indirect network externalities in such a framework. Moreover, considering positive indirect externalities in a vertically interrelated oligopoly provides no robust result concerning the socially optimal entry. This is in contrast with the previous research that, under spatial oligopolistic competition with fixed set-up costs, the level of market penetration in the free-entry equilibrium is always excessive. Within this model, a social planner has to anticipate the distribution of preferences under a given number of copyright owners and users and then to decide whether to foster competition and to act in one group's best interest while the other group incurs losses.

A Appendix

Quasi-concavity of the profit function in prices and royalties let us derive the optimal market-sharing equilibrium price $\widetilde{p}$ and royalty $\widetilde{w}$. Therefore, second order conditions must hold. The corresponding Hessian matrix read,

$$H(\pi^M) = \begin{bmatrix} \frac{2m\tau}{4\lambda\theta - t\tau} & \frac{-2n\theta - 2m\lambda}{4\lambda\theta - t\tau} \\ \frac{-2n\theta - 2m\lambda}{4\lambda\theta - t\tau} & \frac{2nt}{4\lambda\theta - t\tau} \end{bmatrix}. \tag{26}$$

To insure quasi-concavity, the Hessian must be negative semi-definite. It follows, that the first principal minor $D_1 = \frac{2m\tau}{4\lambda\theta - t\tau}$ needs to be negative. This is fulfilled, if

$$t\tau > 4\lambda\theta. \tag{27}$$

The next principal minor has to alter its algebraic sign. Thus, the second principal minor, here the determinant $D_2 = \left(\frac{2m\tau}{4\lambda\theta - t\tau}\right)\left(\frac{2nt}{4\lambda\theta - t\tau}\right) - \left(\frac{-2n\theta - 2m\lambda}{4\lambda\theta - t\tau}\right)^2$ has to be positive. This is satisfied, if

$$mnt\tau > (m\lambda + n\theta)^2. \tag{28}$$

Equation (28) can be reformulated to $t\tau > \frac{n\theta^2}{m} + \frac{m\lambda^2}{n} + 2\theta\lambda$. Thus, if $\frac{n\theta^2}{m} + \frac{m\lambda^2}{n} > 2\theta\lambda$, (28) is more restrictive than (27) and it is sufficient to assume $mnt\tau > (m\lambda + n\theta)^2$ to satisfy the second-order conditions ensuring quasi-concavity of the profit function.

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