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Designing Fees for Music Copyright Holders in Radio Services

Roberto Bombana and Carla Marchese*

Abstract

This paper investigates which is the most desirable payment schedule, from a social welfare standpoint, for compensating IPR holders for music broadcast by radio stations. A model of a radio station that acts as a monopoly with respect to listeners and sells ads in a competitive market is presented. Two types of fees, *ad valorem* and *per unit*, are examined. Exploiting the similarity between taxes and fees, we extend results from taxation theory in two-sided markets to show that the case where only one side (i.e. advertisers) pays, while the other (the listeners) receives the service for free, differs somewhat from the case thus far considered by the literature, in which both sides pay. The results mildly support the prevailing regulatory approach, based on *ad valorem* fees.

Keywords: regulation, radio, collecting agencies, IPR fees
JEL Code: H23, H44, L82

1 Introduction

This paper deals with a relatively quiet and mature media market: that of radio stations that mainly deliver music content. This field has not been immune to the generalized changes affecting the media, with the spreading of other forms of music delivery, such as internet stores or peer-to-peer on-line exchanges. Yet radio stations have still managed to maintain and increase their proceeds from advertising, and in some cases to also collect subscription fees. Even so, the relationship between music content suppliers and radio stations is becoming harsher. Authors and the music recording industry no longer regard radio as an indispensable vehicle to boost market demand for their products[1], since many alternatives – from live concerts to the internet — now prevail. At the same time, the huge difficulty of enforcing IPRs makes authors and other suppliers of services in this field more eager to boost their revenue where enforcement is easier, and in this sense radio is certainly a prime target, since its activity is

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[1]According to Waldfogel, 2011, only one seventh of music aired on the radio in one year was released in that same year.

usually regulated and overseen by public bodies. Hence, especially in countries like Canada, where compensation to the authors and suppliers of music is regulated, there is pressure on the regulatory commissions to reconsider the fees paid by radio stations for the music repertoire. A number of studies, undertaken to support regulatory decision-making on these payments, have analyzed various facets of the problem, but given scant attention to the design of the payment schedule[2]. The topic has received some attention in papers about the potential harm to competition of collecting agencies (Katz, 2006). In this paper, however, we do not address competition problems, since our focus is not on the level of fees, but on their structure, which can exert a specific influence on the choices of radio broadcasters both under individual or under collective (collusive) administration of IPR. The design of fees has received much attention in the literature on IPR, though mainly with reference to licensing contracts for patents and technology transfers[3]. In this work, we examine the alternative between royalties computed as a share of radio revenues (*ad valorem* fees), and fees charged *per unit* of music content (where a unit can be defined, e.g., in terms of time, or tunes broadcast). This problem can be traced back to the theory of indirect taxation in two-sided markets since, as will become clear below, in many instances payments for IPR in the radio industry are not prices aimed at covering marginal costs, but rather income transfers intended to cover fixed costs, and can thus be likened to taxes. Kind et al., 2008 and 2011, find that, in monopoly, a higher *ad valorem* tax on the price charged to one side of the market can have the counterintuitive effect of increasing both outputs of a platform. They show how, for example, a newspaper might react to taxation on price by lowering its price in order to increase the number of readers, and so also its proceeds from the (untaxed) advertisers' side. However the above cited works deal with cases in which both sides of the market pay a price. In radio broadcasting, on the other hand, it can happen that only one side pays. This means that some extension is required, and this will be presented in Section 4. By adopting a model that incorporates the idiosyncrasies of the radio industry, we find that *ad valorem* fees as compensation for music content are no worse than *per unit* fees in terms of economic efficiency and quality, but that *ceteris paribus* they tend to convey more revenue to music content IPR holders.

The paper is organized as follows. After a survey of the literature (Section 2), a model of a radio station that delivers mainly music content is presented in Section 3. This paves the way for discussing the effects of the two types of fee (i.e. a *per unit* price or a share of radio revenue) which can be used to pay for music IPR (Section 4), and assessing the implications with respect to social welfare and regulation (section 5). The conclusions follow in Section 6.

[2] See, e.g., Pelcovits (2006), Agrawal (2007), Globerman (2007), and Audley and Boyer (2007). The latter authors, however, motivate their support for an *ad valorem* fee noting that it involves a zero marginal price, which is efficient for a non rival information good.

[3] Ref. among others to Kamien and Tauman, 1986, Wang, 1989 and Sen, 2005.

2 The economics of radio stations

From a theoretical perspective, a promising and influential approach to the economics of radio stations is that of two-sided markets. In fact, radios that rely on advertising, as either a sole or supplemental source of income, act as platforms that seek to attract two sets of customers: listeners and advertisers. According to the definition given by Rochet and Tirole (2006), two-sided markets are "markets in which the structure, and not only the level of prices charged by platforms matters". The structure of prices, which apportions the requested total payment between the two sides, is important because such markets feature network externalities, acting on the two sides (see, e.g., Glen Weyl, 2009). In the case of radio, advertisers benefit from having a large number of listeners, and this is so important that the best price structure for radio can be a corner solution, i.e. a free supply to listeners, with only advertisers required to pay. Listeners in turn can be hurt by ads or like them.

In order to maximize its profits, a monopolistic platform operating in a two-sided market takes into account – and thus to some extent internalizes – the network externalities, however a gap in efficiency still arises. In fact, what matters to the monopoly is the value of the externality for the marginal participant (relevant for setting the applicable price), while an efficient solution ought to consider the average participant (see, e.g., Kind et al. 2010), since inframarginal participants are also affected. Hence the equilibrium supply in a monopolistic two-sided market may be either too large or too small, in a manner comparable to the problem studied by Spence (1975) in his seminal contribution.

A two-sided market approach has also been adopted in econometric analysis applied to radio stations. Network externalities typical of two-sided markets are sometimes not confirmed by empirical analysis (see, e.g. Van Dalen 2010), since advertisers are not interested in large audiences per se, but rather in targeting people belonging to homogeneous groups – such as the young, the housewives etc. – who might be interested in specific products. Of course, the larger these homogeneous groups are, the better.

As far as the market structure is concerned, Jeziorski (2010) examines the wave of radio station mergers that swept the US starting in 1996, when regulatory restrictions were abolished. He reports that, in the US, most advertisers who choose local radio channels are local producers, and so local radio stations can exert market power over them. Instead, in radios catering to larger audiences – whose market share has increased – the market for ads is competitive. Finally, irrespective of the size of their audience, radio stations have market power over their listeners. In Section 3 we will accordingly build a model in which radio stations enjoy monopolistic power with respect to listeners, while the market for ads is competitive.

With reference to the media, many authors have focused on the negative externalities that advertising can impose on readers or listeners. For example, Anderson and Coate (2005) study competition between TV providers in a Hotelling-type oligopolistic model. Platforms must trade off the benefits advertisers bring in terms of revenue against the cost of losing listeners to competitors.

It turns out that regulatory intervention to ban advertisements cannot in general be supported on efficiency grounds. A problem that characterizes these types of models (see, e.g., also Gabszewicz et al. 2002), is the assumption that the listener has a given reservation price for the media product, and suffers a loss that is a function of the amount of advertising. One implication of this is that a monopolist serving a market of identical customers might push advertising to a level that drives the customer's net benefit virtually to zero. In the next section we present a model that embodies a more realistic trade-off between enlisting listeners or advertisers, by taking into account, firstly, that listeners also have alternative uses for their time, and secondly that their willingness to pay can vary depending on the quality features of the broadcast, and not just the amount of advertising.

3 A basic model

Let us consider a market in which the radio station behaves as a monopolist with respect to listeners (i.e. it serves a *niche* audience interested in a specific music style), whereas it can sell ads in a competitive market. During the course of its broadcasts, the radio successively caters to different subgroups of listeners. In other words, for the sake of simplicity, the radio audience is assumed to be made up of subgroups with identical characteristics, except for being exclusively interested in slightly different types of music. Hence the radio delivers the optimal (i.e. the profit maximizing) supply to each group in turn, it starts catering to another group when the previous production is finished, and so forth. Equivalently, the model can be referred to a representative programme within the radio's production output[4].

Let us assume that the potential listener has a demand price (per unit of time) for listening to the music radio station of his choice given by:

$$\begin{aligned} &P(x,q) = vp\left(x,q\right), \\ &p\left(x,0\right) = 0, \quad q \leq x, \quad p_x < 0, \quad p_q > 0, \quad p_{qx} \gtreqless 0 \end{aligned} \tag{1}$$

where v indicates the agent's type and can take values uniformly distributed on $[0,1]$, while x is the quantity of broadcasting time, q is the quantity of music broadcast (again measured in time), $(x-q)$ is time occupied by ads, if any, and subscripts indicate derivatives. The two dimensions x and q that characterize production contribute to determine its quality, which can be described by the index $\frac{q}{x} \leq 1$. Quality is thus higher the better the contents are aligned with what the listener wishes[5] to receive (i.e. music of a specific type)[6]. By subscribing

[4] If the period needed to serve all groups of customers leaves some free time, the radio can re-run some of its previously produced programming at zero cost.

[5] The model might be extended to consider radio stations which cater to listeners interested in many types of content, e.g. including news, talk etc., so that quality would also depend on the availability of these contents, rather than just on music as is the case here. We leave this extension to future research.

[6] Although equating quality with the proportion of music is a strong assumption, it is a

(or tuning in, when listening is free), listeners gain access to broadcasting to which the music content is tied (i.e., they cannot form their preferred mix of content as they might do, e.g., on a platform that delivers content on demand). In such a model, advertisements do not represent a nuisance per se, but can indirectly negatively affect listeners to the extent that they subtract time from music, while listeners will drop out in the limiting case that only advertisements are broadcast.

Quantity of broadcasting x and music q are public goods for the subscribers (or the free listeners for commercial radios) and all customers have access to the same amount of these goods. The two dimensions that characterize production, i.e., x and q, can be seen as "complements" (when $p_{qx} > 0$) or "substitutes" for the listeners. Moreover, in choosing her preferred quantity, consumers also take into account the opportunity cost of time devoted to listening $h(x)$, with $h(0) = 0$, $h_x > 0$ and $h_{xx} \geq 0$. While the demand price is decreasing in x, the consumer rent can increase, so long as the listener likes the preferred programme to last longer, even with the music more "diluted" by ads. On the other hand the listener will drop out if the demand price drops below the marginal cost of time. Cunningham and Alexander (2004) likewise assume that ads do not directly hurt consumers and that listening time is costly, but they presuppose that only content different from ads is relevant to consumer utility. An implication of their model is that listening time always decreases if on average, for any given content (q in our case), more ads are aired, a consequence that seems overly mechanical and not supported by empirical data.

With respect to subscription fees, we model the case in which no discrimination is possible, so that the radio simply chooses a fixed amount T that must be paid by all subscribers. A consumer will thus subscribe as long as her net rent is positive.

Hence, when a subscription fee is charged, listeners are those who meet the following condition:

$$\int_0^x vp(s,q)\,ds - T - h(x) \geq 0 \tag{2}$$

i.e., those who have a consumer rent greater than or equal to the fee plus the total opportunity cost of time. The number of subscribers will then be given by:

$$N^s(T,x,q) = 1 - v^* = 1 - \frac{T + h(x)}{\int_0^x p(s,q)\,ds} \tag{3}$$

where v^* solves (2) for equality. We consider only full listeners[7], according to

simplification of a more realistic case, in which q is conveniently disaggregated into quality classes, e.g. according to widely accepted rankings of best-sellers, etc. For indexes of musical quality see Waldfogel 2011.

[7] That is to say, those who listen to the entire x. "Partial" listeners might, e.g., be those who turn off the radio when ads are broadcast. Inframarginal listeners, instead, are rationed and would like to receive a larger amount of x.

a simplification currently adopted in the literature (see, e.g., Jeon and Rochet 2010) on media industries.

When no fee is charged, the listeners are those whose demand price is greater than or equal to the marginal cost of time, i.e.

$$vp\left(x,q\right) \geq h_x. \tag{4}$$

The number of listeners is given by:

$$N(x,q) = 1 - v^{**} = 1 - \frac{h_x}{p\left(x,q\right)} \tag{5}$$

where v^{**} solves (4) for equality.

The profit of the radio that relies on both subscription fees and advertisements can thus be written as:

$$\pi^s(T,x,q) = (1-t)\left\{N^s(T,x,q)\left[T + a(x-q)\right]\right\} - c(x,q) - \tau q, \quad q \leq x \tag{6}$$

where $0 < t < 1$ is an *ad valorem* fee paid by the radio to the music IPR holders[8], a is the price applied for advertisements (per unit of listener and of time), $c(x,q)$ is total broadcasting cost, which is assumed to be increasing separately in each variable and convex, while $\tau > 0$[9] is a *per unit* compensation paid to music IPR holders. Hence the radio station revenue comes either from subscription fees T and/or from the advertising market price a.

In the competitive market for advertising, the price a will reflect not just the production costs but also a rent that advertisers must pay to the radio station, in exchange for accessing the pool of listeners over which the latter has market power. In other words, advertisers are required to pay compensation for any negative effects of advertising on the station's revenues from subscription fees (but no more than this amount, since the market for advertisements is competitive).

3.1 The profit maximizing output

Let us focus on the case where a radio station relies only on ads, which is the one more likely to be problematic in terms of quality.

The profit function becomes:

$$\pi(x,q) = (1-t)N(x,q)a(x-q) - c(x,q) - \tau q \tag{7}$$

[8] We assume that the rate is taken as a given by the radio, since it is either set by a regulator or it is negotiated by a representative organization under public supervision, through a process over which the single individual firm has a negligible control.

[9] This rate, too, is given. Katz (2006) points out that in a market where authors compete on an individual basis, some authors might be willing to pay a price (corresponding to a negative τ) to air their songs, in order to advertise their activity and boost the sales of related products (CDs, etc.). In this case, however, variable a would reflect the competitive price of all ad types, including those demanded by authors.

In the following we will assume that (7) is well behaved, while the constraint $q \leq x$ is not binding. The FOCs are:

$$(1-t)\left[N_x a(x-q) + Na\right] - C_x = 0 \tag{8}$$

$$(1-t)\left[N_q a(x-q) - Na\right] - C_q - \tau = 0 \tag{9}$$

where the terms in square brackets represent marginal revenue with respect to quantity of broadcasting x (denoted MRx from now on) and with respect to the amount of music q (denoted MRq from now on). Both must be positive since the marginal (net of tax) revenue must equal the positive marginal cost. Moreover, by deriving $N(x,q)$ as defined in (5) with respect to x we get

$$N_x(x,q) = -\frac{h_{xx}p(x,q) - p_x(x,q)h_x}{\left[p(x,q)\right]^2}$$

which is negative because $h_{xx} > 0$ and $p_x(x,q) < 0$, while

$$N_q(x,q) = \frac{h_x p_q(x,q)}{\left[p(x,q)\right]^2}$$

is positive since $p_q > 0$. Summing up, increasing x for a given q (which means airing more ads) reduces the number of listeners, while increasing q for a given x has the opposite effect.

By substituting for $Na(1-t)$ from (9) into (8) we get:

$$(1-t)\left[\left(N_x + N_q\right)a(x-q)\right] - C_x - C_q - \tau = 0$$

Hence

$$N_q > |N_x| \tag{10}$$

must hold in order to have an overall positive marginal revenue. Under the reasonable assumption that $N_{qq} < 0$ (that is the number of listeners increases in q but at a decreasing rate), for a given x the radio can restrict the production of q, thus making room for more ads while at the same time helping to fulfil[10] condition (10). Can and should the regulator correct this negative effect on quality? How does this choice impinge on regulating compensation to authors' collecting societies, and to music content suppliers in general? This discussion is postponed to Section 5, after examining the specific effects of the two alternative types of fees.

4 The effects of authors' compensation systems

4.1 The effects of the *ad valorem* fee

In order to assess the effects of the *ad valorem* fee, we differentiate the FOCs with respect to t and solve the resultant system of equations for $\frac{dx}{dt}$ and then

[10] Note that from (3) and (6) $N_x^s > 0$ must instead hold for a radio that relies only on subscription fees. In other words, such a radio, which receives payment for x only from listeners, will produce it only insofar as the marginal revenue, given by $(1-t)N_x^s T$, is positive.

for $\frac{dq}{dt}$ by applying the Cramer rule[11]. With reference to $\frac{dx}{dt}$, this leads to (11). The sign of H, which is the determinant of the Hessian matrix obtained by differentiating the profit function, is positive because of the assumption that the second order condition for profit maximization holds.

$$\frac{\begin{vmatrix} MRx & \pi_{qx} \\ MRq & \pi_{qq} \end{vmatrix}}{H} \tag{11}$$

The sign of $\frac{dx}{dt}$ thus coincides with that of the determinant of the numerator, which is given by:

$$MRx\pi_{qq} - \pi_{qx}MRq \tag{12}$$

The first term in (12) is clearly negative, and thus if there are no cross effects $\frac{dx}{dt} < 0$. Otherwise the sign depends on that of the cross effects π_{qx}, that is $\frac{dx}{dt} > 0$ if $\pi_{qx} < 0$ and

$$|\pi_{qx}MRq| > |MRx\pi_{qq}| \tag{13}$$

With reference to $\frac{dq}{dt}$, the sign depends on that of the determinant of the numerator of the following matrix

$$\frac{\begin{vmatrix} \pi_{xx} & MRx \\ \pi_{qx} & MRq \end{vmatrix}}{H} \tag{14}$$

The determinant is

$$\pi_{xx}MRq - \pi_{qx}MRx \tag{15}$$

Thus $\frac{dq}{dt} < 0$ if there are no cross effects, while $\frac{dq}{dt} > 0$ if $\pi_{qx} < 0$ and

$$|\pi_{qx}MRx| > |MRq\pi_{xx}| \tag{16}$$

It must be noted, however, that it cannot happen that both $\frac{dq}{dt}$ and $\frac{dx}{dt} > 0$, i.e. that both q and x increase following an increase in the *ad valorem* fee, since this would violate the second order condition. This can be seen by multiplying side by side inequalities (13) and (16), to obtain:

$$(\pi_{qx})^2 MRqMRx > MRqMRx\,(\pi_{xx}\pi_{qq})$$

which implies that

$$(\pi_{qx})^2 > \pi_{xx}\pi_{qq}$$

which is a violation of the second order condition.

We can thus conclude that, in the absence of cross effects the *ad valorem* fee reduces both x and q, whereas if there are substitutability effects it might decrease one and increase the other. The effects on the quality index $\frac{q}{x}$ are ambiguous.

[11] For this standard approach to comparative statics, see, e.g., Varian, 1992, pp. 494-495.

These results can be compared to those of Kind et al., 2010, who find that both output dimensions of a platform's production in a two-sided market can expand in response to *ad valorem* taxation. They assume, however, that both sides of the market pay a price but that only one side is taxed. A decisive role in explaining their result is played by cross effects between demand for the two goods, which originate from two different groups of agents. The possibility of an output increase in response to taxation has been previously considered in the literature, and can be traced back to the so called Edgeworth taxation paradox. Edgeworth[12] showed that a monopolist selling two substitute goods might reduce the prices of both when one of the goods is taxed. The idea is that taxation will induce a shift toward producing more of the untaxed good - thereby lowering its price - and in case of substitutability the price of the taxed good might also fall. The subsequent literature[13], however, pointed out some limitations of the Edgeworth paradox, showing, e.g., that if the demand for both goods comes from the same representative consumer and there is no income effects, no more than one price can decrease (Bailey, 1954), since cross effects are limited due to the second order condition for utility maximization.

While thus the result of Kind et al. are reminiscent of the Edgeworth taxation paradox in its more striking version[14], our results, referred to the case of a two-sided market in which only one side pays a price, recall (again in a different scenario) the more limited effects of *ad valorem* taxation that have been observed for cases in which cross effects are "capped" by second order conditions.

4.2 The *per unit* compensation system

The *per unit* system is in practice often used for special events or with reference to classical music or grand opera, but it could in principle be extended to the entire music repertoire.

Turning now to consider $\frac{dx}{d\tau}$, and following the same approach, based on total differentiation of the FOCs and application of the Cramer rule to solve the system of equations, we find that the sign depends on that of the determinant of the following matrix:

$$\begin{vmatrix} 0 & \pi_{qx} \\ 1 & \pi_{qq} \end{vmatrix}$$

The determinant is thus

$$-\pi_{qx}$$

and hence the sign of $\frac{dx}{d\tau}$ is dependent on cross effects. With respect to $\frac{dq}{d\tau}$, the

[12] Edgeworth's theorem appeared in "la teoria pura del monopolio" published in an Italian journal (Giornale degli economisti) in 1897; see also Edgeworth (1899) and (1910).

[13] See, e.g., Bailey, 1954, and Creedy, 1988.

[14] Actually they go further, since Edgeworth says that the output of the taxed good drops even if its price falls, while in the two-sided market case considered by Kind et al. both outputs can instead increase.

relevant matrix is:

$$\begin{vmatrix} \pi_{xx} & 0 \\ \pi_{xq} & 1 \end{vmatrix}$$

The determinant is:

$$\pi_{xx}$$

Since π_{xx} is negative by the second order conditions, the sign of $\frac{dq}{d\tau}$ is negative. Summing up, this means that a *per unit* fee always negatively affects the amount of music broadcast. This is the only effect if $\pi_{qx} = 0$, while if $\pi_{qx} < 0\,(> 0)$, then x will increase (decrease). These effects correspond to those found by Kind et al. (2010).

5 Problems of regulation

The agents involved in the problem under consideration are listeners, broadcasters, advertisers and authors/producers of music. Evaluating the role of advertisers from a social welfare perspective is highly problematic. To tackle this, an intermediate assumption (which also makes it possible to employ a partial equilibrium approach, thus avoiding the need to also model the markets for the advertised goods) is that no net consumer's rent accrues to advertisers, so that the net welfare effects of advertising coincide with the externalities imposed on listeners[15]. Since both x and q are public goods, the regulator ought not to restrict access and, applying the Samuelson rule, should seek to maximize the net rent accruing to the average listener. The regulator's problem is given by:

$$\max_{x,q} \int_0^x v^{\mu}(s,q)p\,(s,q)\,ds - h\,(x) + a(x-q) - \frac{1}{2\,[1-v^{\mu}(x,q)]}c(q,x) \qquad (17)$$

where the first term describes the consumer rent of the average listeners and $v^{\mu}(x,q)$ refers to the average listener's type. The per capita proceeds from ads $a(x-q)$ are included, since they are an income source that contributes to cover the per capita[16]costs $\frac{1}{2[1-v^{\mu}(x,q)]}c(q,x)$. Note that advertisements - by contributing to determine the optimal x and q - also produce externalities affecting the willingness to pay of the average listener.

By comparing this problem with that of profit maximization (see Section 3), we find that a fundamental difference lies in which consumer is considered, since (7) is referred to the marginal consumer, while (17) is referred to the average consumer. Given that the average consumer's willingness to pay for music may be either greater or less than that of the marginal consumer, a market solution

[15] If advertising is described as a free entry rent-seeking game - where rent opportunities are created through product differentiation - rents will be dissipated in equilibrium.

[16] Note that, since listening incurs a private cost in terms of time, it might happen that some potential listeners are lost when x and q are set at their optimal social level. Since a uniform distribution of v on $[0,1]$ has been assumed, the mean listener is also the median listener, and thus the total number of listeners is $2\,[1-v^{\mu}(x,q)]$.

could result in either overprovision or underprovision of music[17]. This implies that any regulatory intervention aimed at influencing quality (i.e. the incidence of ads) cannot rely on general rules but has to be tailored to the specific case under consideration.

In (17) no marginal cost was considered for the provision of music on the part of IPR holders, because radios mainly resort to the stock of already-existing tunes, recorded songs, etc. for their programmes. However, the regulator is likely to aim to set the fees that radio stations must pay at a level that covers the IPR holders' fixed costs, so as to make their activity viable in the long run. As long as the market works as described in Section 3, the regulator can thus compare *ad valorem* and *per unit* fees. Alongside the effects already described in section 4, the *ad valorem* fee has the characteristic of also taxing the monopoly pure profit. That is to say, if we compare two radio stations that deliver equal amounts of x and q, one under a *per unit* and the other under an *ad valorem* fee, we get the standard result that the proceeds collected through the *ad valorem* fee are larger.

To show this, let us compare[18] the two profit function, i.e., (18) for the case in which there is just a *per unit* fee and (19) for the case in which there is just an *ad valorem* fee:

$$N^s(T,x,q)\left[T+a(x-q)\right]-c(x,q)-\tau q \tag{18}$$

$$(1-t)N^s(T,x,q)\left[T+a(x-q)\right]-c(x,q)= \tag{19}$$

$$(1-t)\left[N^s(T,x,q)\left[T+a(x-q)\right]-\frac{c(x,q)}{1-t}\right] \tag{20}$$

As long as $\tau=\frac{c(x,q)t}{(1-t)q}$, the term in square brackets in (20) is equal to profit (18). Under the *ad valorem* fee, however, the revenue also includes the term $(1-t)$, i.e., a further pure profit taxation. The comparison thus shows that *ad valorem fees* can replicate the effects on the market of the *per unit* fees (meaning that they can be compatible with the same outputs), while also producing extra revenue. Hence from the point of view of advertisers and consumers, the two approaches are interchangeable - provided that the respective rates are appropriately chosen - while from the distributive point of view the *ad valorem* fee permits a further income transfer from radio stations to music content suppliers. Similarly, the analysis of the effects on x and q (see section 4) mildly points to *ad valorem* fees providing more support to music content suppliers, since they can cause q to increase, whereas the opposite is always true under a *per unit* fee.

[17] This effect has been described in the seminal paper of Spence, 1975.

[18] For this approach see, e.g., Anderson et al., 2001.

6 Conclusions

From the theoretical point of view, this paper contributes to the literature on taxation in two-sided markets by considering a case where only one side – on which the platform faces competition – pays a price, while on the other side the platform has monopolistic power but finds it profitable to deliver its service for free. This scenario yields up some counterintuitive results, i.e. that under an *ad valorem* fee one output dimension can expand. Since the other is at any rate always negatively affected, our results, in comparison with those of Kind et al. 2008 and 2011, are more aligned with the observations set forth in the discussion of the Edgeworth taxation paradox, where possible departures from the standard negative effects of taxation on output are shown to hold only for one out of two goods produced by a monopolist.

With respect to the problem of regulating compensations for music IPR, we show that the same quantities of broadcasting and advertising time can be attained under both *ad valorem* and *per unit* fees, provided that the respective rates are suitably set. *Ceteris paribus*, however, the *ad valorem* fee permits a larger pure revenue transfer from radios to the suppliers of music. This feature seems to accord with regulators' current concerns, given authors' difficulty in collecting revenue from music, and the low returns of airing music by radio, in terms of promoting further sales.

Aside from the problem of choosing the type of royalty/tax for IPR, regulators also face a difficult choice in setting the level of the rate. If we accept the assumption that authors' collecting agencies are entitled by the law to exploit rents arising from use of works of their members, the Shapley value approach becomes a viable method for solving the problem of apportioning profits between monopolistic radio stations and IPR collecting agencies, and it has in effect often been cited in the literature. In the same vein, Watt, 2010, has recently suggested that the revenue share for authors might be set at the level resulting from a fair Nash bargaining solution between the two monopolistic parties, i.e. the radio stations and the collecting agencies. However, from a wider social perspective, such a negotiation should also include listeners, to share in the total net benefits of production. This because, even for commercial radios, decisions concerning compensations for IPR holders impact on listeners, by affecting the quantity and quality of the radio stations' output. Taking the welfare of listeners into account when designing regulatory interventions is all the more important because listeners are less likely than other stakeholders to significantly influence the authorities' decisions through lobbying.

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