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How Effective Are Advertising Bans? On the Demand for Quality in Two-Sided Media Markets

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How Effective Are Advertising Bans? On the Demand for Quality in Two-Sided Media Markets

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Abstract

We study a two-sided markets model of two competing television broadcasters that offer content of differentiated quality to ad-averse consumers and advertising space to firms. As all consumers prefer high over low quality content, competition for viewers is vertical. By contrast, competition for advertisers is horizontal, taking into account the firms' targeted advertising motive. Analyzing the impact of both, the strength of mutual externalities and advertisement regulation policies, we find the following results: First, broadcasters' profits increase and welfare decreases in the viewers' nuisance costs of advertising. Second, welfare may decrease in the effectiveness of informative advertisement, too. Third, an advertising ban on the high quality medium reduces its viewer market share and thereby the equilibrium reception of high quality content.

JEL Classification: D21, H23, L13, L51, L82

Keywords: two-sided market, advertising ban, platform competition, network externalities, horizontal and vertical product differentiation

1 Introduction

Advertising in the media and especially on television is subject to various regulations some of which include an advertising ban. The reasons to ban advertisements from the media are as diverse as the regulatory tools at hand: advertising for some products may be restricted (product restrictions),[1] the restrictions may be binding within a special time period during the day (time restrictions), or may apply to special types of media (type restrictions). The latter are often imposed simultaneously such that public service broadcasters are not allowed to carry advertisements during a certain time of day.[2]

A combination of time and type restrictions is currently in place in Germany. German public service prime-time television is ad-free from 8pm. In January 2009, France installed the same regime as in Germany, forbidding their public service broadcasters to carry advertisements from 8pm through 6am. This resulted in a loss of advertising revenues of 187.6 million Euro in 2009.[3] Plans to install a day and night advertising ban, which were under debate in 2012 and would have turned the French system into a pure type restriction regime, have not been realized.

The common argument in favor of public service broadcasting builds on the governmental duty of guaranteeing basic provision of information and other content that meets a certain quality standard. In this regard, (time) restrictions for advertisement in public broadcasting may pursue two related goals: One objective seems to be a reduction of the advertising volume in the market since advertisements are widely regarded as utility-reducing nuisance for consumers. By (temporarily) eliminating the nuisance from advertisements, the second (and maybe more important) objective seems to consist of making quality content more attractive to the audience. Hence, one might expect that such a policy leads to higher market shares for the public service broadcaster, i.e. increasing reception of quality content.

However, the model developed in this paper shows that such reasoning is misleading on a two-sided media market where broadcasters compete for viewers and advertisers. Since the number of viewers exerts a positive externality on advertisers, competition for advertisers intensifies competition for viewers. An advertising ban

[1] Since the 1980ies, many OECD countries imposed advertising bans for instance on tobacco as well as on (some or all) alcoholic beverages, or even on junk food (UK, South Korea). The aim of this policy instrument is to reduce consumption of unhealthy goods but its effectiveness is discussed controversially in the literature. While some authors find little or no negative effects of advertising bans on consumption (Frank, 2008, Nelson, 1999, Seldon et al., 2000, Stewart, 1993), other authors find that there are circumstances under which an advertisement ban may reduce consumption (Saffer and Chaloupka, 2000, Blecher, 2008).

[2] See Anderson (2007) for a comprehensive overview over advertising regulation in different countries.

[3] See "Le rapport financier du groupe", the annual report of the French public service broadcasters France Télévisions, available through *www.francetelevisions.fr*.

on one type of broadcaster, though, asymmetrically eliminates this type's additional motive for attracting viewers. In equilibrium, the ban leads to a reduction of the restricted type's share in the viewer market. Consequently, if the type restriction applies to high quality media, the ban reduces the reception of high quality content.

More formally, we consider a model of a two-sided media market where two television channels compete in prices for viewers and for advertisers. The number of viewers exerts a positive externality on the profits of advertisers and is expressed by a likelihood parameter of consumers buying the advertised product (effectiveness of advertisement). The number of advertisements exerts a negative externality on viewer utility and is captured by a nuisance parameter. There is single-homing on both sides of the market.

We assume that the content the broadcasters offer to viewers is differentiated with respect to quality. Viewers differ in their valuation for the quality of content. But since all viewers ceteris paribus prefer high quality over low quality content, competition on the viewer market is vertical. By contrast, competition for advertisers is horizontal, taking into account their targeted advertising motive: The advertised products may differ (e.g. in quality) such that there is some correlation with the viewers' preferences for the quality of content. Successful advertising makes use of the fact that these preferences are sorted by the quality of content offered by the broadcasters.

We analyze the market equilibrium for two types of scenarios: symmetric ones in which both broadcasters are allowed to sell advertising space, and an asymmetric scenario with an advertising ban on the high quality medium. We find that the standard result of models with vertical product differentiation in one sided markets still holds in our two-sided market framework and is stable across scenarios: selling high quality content is an advantage that allows for higher prices on both sides of the market and leads to higher profits.

A common feature of two-sided market models is that the intensity of the external effects is crucial for equilibrium outcomes. Hence, we conduct a comparative statics analysis in order to study how a variation of the negative and positive externality parameters affects the outcome. We find that an increase in the nuisance parameter raises the broadcasters' profits (Reisinger, 2012, Proposition 2) and lowers welfare. Surprisingly, an increase in the likelihood parameter, i.e. the effectiveness of informative advertisements, may also reduce welfare if the advertising market is not fully covered. The reason is that the higher profits of advertisers and broadcasters may be overcompensated by the fact that viewers suffer in three ways: from higher viewer prices, more advertisements, and lower average quality of content.

Finally, we evaluate the effectiveness of an advertising ban on the high quality medium comparing the equilibrium outcomes under the symmetric and asymmetric scenarios. We obtain the following results: Preventing the high quality medium from entering the advertising market does in fact reduce total advertising volumes.

However, it leads to less consumers watching the high quality program, and to lower welfare.

Besides these findings, which are relevant for political decisions on the use of type restrictions for advertising in two-sided media markets, the paper also offers a methodological contribution. Considering a product characteristic – like the quality of content in our model – which is perceived as a feature of vertical differentiation on one side and a feature of horizontal differentiation on the other side of a two sided market, is new to the literature.[4] It allows to capture an additional form of strategic interdependence between the two sides of the market – like the targeted advertising motive in our model – that goes beyond purely quantitative network effects.

The remainder of the paper is organized as follows: Section 2 provides an overview of the related literature. Section 3 describes the formal model and the basic assumptions. In Section 4, we identify the equilibria that arise under three different regimes: two symmetric ones where both media outlets carry advertisements, and an asymmetric one with an advertising ban on the high quality broadcaster. Since the number of viewers exerts a positive externality on advertisers‘ profits, and the number of advertisements exerts a negative externality on consumers‘ utilities, we analyze the related comparative statics in Section 5. In Section 6, we examine whether an advertising ban is suited for reaching the policy goals of reducing the amount of advertisements, and making the quality broadcast more attractive to consumers. Section 7 concludes.

2 Related Literature

This paper builds on the two-sided market literature initially addressed by Rochet and Tirole (2003, 2006), Armstrong (2006), and Caillaud and Jullien (2001, 2003) who analyze network externalities and pricing in different contexts.

The basic tradeoff between audience and advertising is well documented in the literature (see for instance Anderson and Gabszewicz (2006), Dukes and Gal-Or (2003)). Broadcasters can either sell more advertisement slots and thus increase their revenues from advertising, or reduce the amount of advertisements which attracts more consumers since consumers are assumed to consider advertisements as a nuisance. Reisinger (2012) analyzes competition for advertisers and consumers in a framework which is similar to our model. In contrast to our analysis, though, he assumes platforms to be homogeneous from the viewpoint of advertisers, and viewer prices to be zero. His results, however, are in line with our findings: the profits of the media outlets may increase if user nuisance from advertising rises, and private TV platforms may benefit if their public rivals are regulated to advertise less.

[4] An exception is Kotsogiannis and Serfes (2010) who combine vertical and horizontal differentiation in a tax competition framework.

Ferrando et al. (2008) also analyze two media outlets that compete in the consumer as well as the advertising market, and evaluate the effect of the externalities between both sides of the market. In contrast to our model, they differentiate between ad-loving and ad-averse consumers. Advertisers, however, only care about the number of consumers that can be reached by an advertisement, and not about targeting a certain group.

Anderson and Coate (2005) conduct a welfare analysis and find that monopoly media ownership may increase welfare. The authors assume that there are no direct costs of media use by consumers besides nuisance costs from advertisements, and costs from not receiving the preferred program. Dukes (2004) obtains qualitatively the same welfare implications in a similar framework. In our model, however, media outlets charge positive prices which can be interpreted as monthly subscription fees for watching the respective channel.

Consumers' attitude towards advertisements is also the topic of various studies. Kind and Stähler (2010), for instance, determine equilibrium advertising shares with consumers being either ad-lovers, ad-averse or neutral. In our paper, consumers are ad-averse and have vertical preferences with respect to broadcasting quality.

To our knowledge, the effectiveness of (time restrictions in combination with) type restrictions of advertisement has not been analyzed in a full-fledged two-sided markets model taking into account the interplay between low quality (commercial) and high quality (public service) broadcasting. Anderson (2007) was the first to evaluate the effects of advertising caps (time restrictions that apply to all broadcasters) on broadcasting quality in a theoretical model. Similarly, Kerkhof and Münster (2015) study quantity restrictions on advertising in the presence of commercial media bias and show that advertising caps increase the price of advertising. As a consequence, media content improves from the viewers' perspective which possibly increases welfare.

Mullainathan and Shleifer (2005) focus on media financing and show that financing via subscription fees leads to media outlets slanting news towards the beliefs of consumers. However, they do not include advertising as a source of media financing into their analysis. Peitz and Valletti (2008) differentiate between pay-tv and free-to-air stations and analyze advertising intensity as well as content of programming. They find that there is more advertising in the free-to-air regime. Media financing also plays a crucial role in our framework, but we focus on advertising and viewer revenues without including media slanting, and commercial television in our model is not free-to-air.

Kind et al. (2007) perform a welfare analysis endogenizing media quality and find that a merger between TV channels may be welfare improving. In our model, quality is exogenously fixed in order to obtain results that will hold even if the quality of the medium that is not allowed to carry ads is maximum.

3 The Model

We consider a duopoly model of a two-sided media market. Two competing broadcasters (or, more generally, platforms) offer content of a certain quality to viewers (consumers) and advertising space to advertisers (producers). In this section, we specify the decision problems for the three types of agents as well as the structure of the underlying market game.

3.1 Broadcasters

Two broadcasters $j \in \{A, B\}$ compete for market shares n_j^{ad} in the advertising market offering advertising space and for market shares n_j^v in the viewer market offering content of a certain quality $x_j \in [0, 1]$. We treat the quality levels as exogenously given and discuss this assumption in detail below. Hence, the broadcasters' strategic variables are viewer prices p_j and advertising prices τ_j.

To simplify the exposition, the broadcasters' costs are assumed to be zero. With the quality of content being exogenously fixed, quality costs would enter the profit function of the media outlets as fixed costs and thus have no impact on the optimal pricing decision on either side of the market. Moreover, marginal costs of additional viewers or advertisers may be negligible. Hence, the profit of broadcaster j consists of the revenues generated on the advertising market and on the viewer market

$$\Pi_j = n_j^{ad}\tau_j + n_j^v p_j. \tag{1}$$

We often refer to n_j^{ad} as the number of advertisers who choose to place their advertisement in medium j, and n_j^v as the number of viewers who watch medium j. Both, the total number of advertisers and the total number of viewers, are normalized to unity.

3.2 Viewers

There is a continuum of viewers who differ with respect to their individual valuation of the quality of media content $v \in [0, 1]$, which is uniformly distributed on the unit interval. We assume that viewers single-home, i.e. that they are watching no more than one channel in the period of time under consideration. The utility of viewer $v \in [0, 1]$ when watching channel $j \in \{A, B\}$ is

$$u_{v,j} = \bar{u} + vx_j - \beta n_j^{ad} - p_j. \tag{2}$$

Gross utility $\bar{u}$ is assumed to be sufficiently large such that, in equilibrium, each consumer has a positive net utility from watching television. For simplicity, we assume that $\bar{u} > 1$ which implies that the viewer market is always covered.

The utility of each consumer is strictly increasing in the broadcasting quality x_j. However, viewers differ with respect to their valuation v of quality. Therefore, content of differing quality is a source of vertical product differentiation on the viewer market.

The number n_j^{ad} of advertisements in medium j exerts a negative externality on its viewers, which is supposed to be linear in our model. The strength of this externality is expressed by the parameter $\beta \in (0, 1]$ capturing the marginal nuisance from advertising. The assumption that advertising is a nuisance to viewers is empirically supported for instance by Wilbur (2008) who finds that a 10 % increase in advertising time induces an audience loss by 25 %.[5] We assume that the degree of ad-aversion is the same for all consumers. In the comparative statics part in Section 5, we analyze how the degree of ad-aversion affects the equilibrium outcomes.

Note that the utility the consumers get from consuming an advertised good is assumed to equal zero. This is justified below discussing the market transactions between consumers and producers.

3.3 Advertisers

There is a continuum of advertisers who differ with respect to the type of the good they produce, $\gamma \in [0, 1]$, which is uniformly distributed on the unit interval. As for viewers, we assume that there is no multi-homing for advertisers, i.e. they face a discrete choice between either placing an advertisement in medium A or medium B or none at all. The profit of advertiser $\gamma \in [0, 1]$ when advertising on channel $j \in \{A, B\}$ is

$$\pi_{\gamma,j} = \bar{a} + \delta n_j^v - |\gamma - x_j| - \tau_j, \tag{3}$$

and $\pi_\gamma = 0$ when abstaining from the advertising market.

The parameter $\bar{a}$ accounts for the fact that advertisers may derive a reputational gain from advertising per se that is not directly reflected in the profits from selling the advertised product. Below, we first consider a situation in which $\bar{a}$ is sufficiently high such that, in equilibrium, entering the advertising market is always profitable for an advertiser (symmetric advertising without market abstention). Then we allow for market abstention setting $\bar{a} = 0$.

The number n_j^v of consumers who watch channel j and thus are exposed to advertisements on this channel exerts a positive externality on the producers advertising via this channel. The strength of this externality is expressed by the parameter $\delta \in (0, 1]$. It may be interpreted as the fraction of viewers who buy the advertised products. The stronger this externality, i.e. the higher δ, the more valuable is

[5] There are, however, instances in which viewers are ad-lovers, e.g. in the case of superbowl commercials. The restriction to a negative advertising externality is mainly due to the ease of exposition.

an advertisement to the advertisers as it represents the receptiveness of consumers towards advertisements in general.

This formulation may serve as a shortcut for an explicit model of the market transactions between consumers and producers along the following lines (cf. Reisinger, 2012): Advertisers are monopolists for the variety γ of the good they produce at zero marginal costs. By means of advertising, a producer tries to inform viewers who are prospective consumers about the existence of its product. For all consumers, the expected willingness to pay for each producer's good equals $k = 1$.[6] It can be fully extracted by the producer, if the respective consumer gets aware of the existence of the product. In this context, δ may be understood as the probability that a consumer will get aware of the existence of a product if he is exposed to the respective advertisement.

The advertiser's profits are negatively related to the distance $|\gamma - x_j|$ between the quality level that is ideal for a successful marketing of its type of product γ and the quality actually offered by the respective broadcaster x_j. In other words, content of differing quality is a source of horizontal product differentiation on the advertiser market. There are at least to ways of how to interpret this kind of modeling as a mode of so called *targeted advertising*. First, the type of product offered by a certain advertiser γ may be understood as the (intended) image of the product (or the advertiser's self-image). Advertising via a certain medium, the advertiser then suffers from the discrepancy between this (intended) image and the image conveyed by the medium which is closely related to the quality of content it offers. Second, γ might depict the quality of the advertiser's product. If there is a positive correlation between the consumers' tastes for quality when it comes to media use and when it comes to the consumption of other goods, then the advertiser's type will determine his target group: For example, a high type advertiser tries to make use of the fact that consumers who have a high willingness to pay for quality broadcasts also have a higher willingness to pay for his good than consumers who watch the low quality broadcast. Hence, the type of an advertiser translates directly into his preferred broadcasting quality.

Modeling targeted advertising as a source of horizontal product differentiation on the advertiser market in the sense that each advertiser intends to achieve the closest possible match between the quality of the media broadcast and the type of his product captures the fact that advertisers value not only the size of the group of viewers who are exposed to their advertisement, but also the profile of this group.

[6] This is a simplifying assumption in order to keep the analysis tractable. In reality, one might expect a user's expected willingness to pay k for a certain product to increase in both γ (if interpreted as a signal for the quality of the product) and v (if interpreted as a signal for the individual's general valuation of quality). However, this effect may be mitigated by the fact that, due to income effects, in reality the distribution of the users' valuation v follows some left skewed income distribution rather than the uniform distribution used in the model.

3.4 Game structure and further assumptions

In our model, the broadcasting quality is exogenous. More specifically, we assume that when broadcasters decide on their program quality (in an early stage of the game not modeled here), they choose maximum differentiation with one broadcaster offering the lowest possible quality ($x_A = 0$) and the other broadcaster offering the highest possible quality ($x_B = 1$). The reason for fixing the quality levels at the extremes is the following: One aim of the paper is to analyze the effects of an advertising ban in the high quality medium B on the viewers' demand for its programme. Since consumers ceteris paribus prefer high quality over low quality, and no advertisements over any positive amount of advertisements, the combination of highest possible quality and no advertisement (as in medium B when the advertising ban is in place) is the most appealing of all quality-advertising combinations. This guarantees that any eventual decrease in viewer market shares of the quality medium induced by the advertising ban is not due to (changes in) the quality settings.

We consider a two-stage game. In stage one, both media outlets simultaneously choose their prices on the viewer market and the advertising market. In stage two, viewers and advertisers simultaneously take their decisions: viewers decide which channel to watch and advertisers decide where to place their advertisement, if any. The game is solved by backward induction for its subgame perfect equilibrium.

For the structure of the market equilibrium, the relation of the externality parameters β and δ is crucial. Throughout we assume $\delta > \beta$. This assures that there is always some producer who finds it profitable to advertise in equilibrium. Put differently, this assumption rules out equilibria without advertising activities.

4 The Equilibria

In this section, we derive the market equilibria under three different regimes called *sym1*, *sym2* and *asym*. Under regimes *sym1* and *sym2* we analyze the situation in which both broadcasters are allowed to sell advertising slots without any restrictions. We refer to these cases as *symmetric advertising*.

In the first regime of symmetric advertising (*sym1*) we assume that the reputational gain from advertising $\bar{a}$ is sufficiently high to ensure market coverage. In this situation, all producers decide to advertise either on channel A or B which implies that the broadcasters' shares on the advertising market are determined by some marginal advertiser $\hat{\gamma}$ who is indifferent between placing his advertisement on channel A and B.

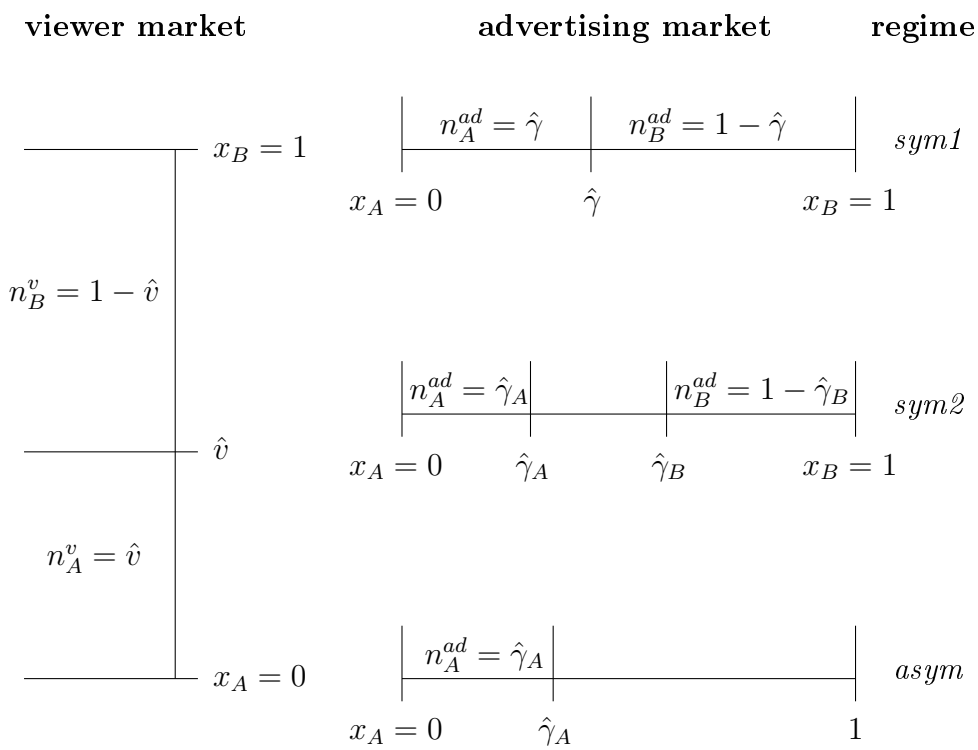
In the second regime of symmetric advertising (*sym2*) we consider a case with abstention in the advertising market setting $\bar{a} = 0$. Given the horizontal structure of the advertising market with maximum differentiation, in this case the extreme types of producers advertise whereas the intermediate types do not. Hence, the market

share of broadcaster $i \in \{A, B\}$ is determined by some marginal advertiser $\hat{\gamma}_i$ who is indifferent between advertising on channel i and not at all.

Under regime *asym*, only the low quality medium A is allowed to enter the advertising market, as an advertising ban for the high quality medium B is in place. We refer to this case as *asymmetric advertising*. In this situation, the market share of broadcaster B is zero and the one of broadcaster A is determined by some marginal advertiser $\hat{\gamma}_A$ who is indifferent between advertising on channel A and not at all.

As mentioned above, we assume throughout that the market for viewers is covered. Therefore, under any regime the broadcasters' shares on the viewer market are determined by some marginal consumer $\hat{v}$ who is indifferent between watching programme A and B. The demand structure of the two market sides under the different regimes are summarized in Figure 1.

Figure 1: Demand structures under the different regimes



As the derivation of the equilibrium is similar for the three regimes, we will present it in detail only for *sym1* and then sketch it for the regimes *sym2* and *asym*.

*4.1 Symmetric advertising without market abstention (*sym1*)*

In the second stage of the game, viewers and advertisers simultaneously make their decisions.

Advertiser $\hat{\gamma}$ will be indifferent between placing his advertisement on channel A and B if $\pi_{\hat{\gamma},A} = \pi_{\hat{\gamma},B}$. Using (3), this is equivalent to

$$\bar{a} + \delta n_A^v - \tau_A - (\hat{\gamma} - x_A) = \bar{a} + \delta n_B^v - \tau_B - (x_B - \hat{\gamma}).$$

Since all types of advertisers with $\gamma \leq \hat{\gamma}$ prefer to advertise on channel A and all types of advertisers with $\gamma > \hat{\gamma}$ prefer to advertise on channel B, the demand for advertisements in medium j is

$$\begin{aligned} n_A^{ad} &= \hat{\gamma} = \frac{\delta\left(n_A^v - n_B^v\right) - \tau_A + \tau_B + (x_A + x_B)}{2}, \\ n_B^{ad} &= 1 - n_A^{ad}. \end{aligned} \tag{4}$$

Viewer $\hat{v}$ will be indifferent between watching channel A and B if $u_{\hat{v},A} = u_{\hat{v},B}$. Using (2), this is equivalent to

$$\bar{u} + \hat{v}x_A - \beta n_A^{ad} - p_A = \bar{u} + \hat{v}x_B - \beta n_B^{ad} - p_B. \tag{5}$$

Consumers choose medium A if their marginal willingness to pay for quality is lower than that of the marginal consumer, i.e. if $v \leq \hat{v}$, and choose medium B otherwise.

Substituting (4) in (5), we obtain the viewers' demand for medium j:

$$\begin{aligned} n_A^v &= \hat{v} = \frac{p_B - p_A + \beta\left(\delta + \tau_A - \tau_B\right)}{1 + 2\beta\delta}, \\ n_B^v &= 1 - n_A^v. \end{aligned} \tag{6}$$

Inserting these results into equations (4) yields

$$\begin{aligned} n_A^{ad} &= \frac{1 - \delta + 2\delta\left(p_B - p_A + \beta\right) - \tau_A + \tau_B}{2\left(1 + 2\beta\delta\right)}, \\ n_B^{ad} &= 1 - n_A^{ad}. \end{aligned} \tag{7}$$

In the first stage of the game, the broadcasters simultaneously set their prices on the viewer market p_j and the advertising market τ_j in order to maximize their profits Π_j as given by equation (1), anticipating the viewers' and advertisers' demands as

given by equations (6) and (7). The necessary conditions for optimal prices $\frac{\partial \Pi_j}{\partial p_j} = 0$, $\frac{\partial \Pi_j}{\partial \tau_j} = 0$, $j \in \{A, B\}$ define a system of four equations with the following solutions:[7]

$$\begin{aligned} p_A^{sym1} &= \frac{1}{4}\left(1 - 4\delta + \frac{3 + 2\beta(\delta - 2\beta)}{9 - 4\beta^2 - 4\delta^2 + 10\beta\delta}\right), \\ p_B^{sym1} &= \frac{1}{4}\left(3 - 4\delta + \frac{3 + 2\beta(\delta - 2\beta)}{9 - 4\beta^2 - 4\delta^2 + 10\beta\delta}\right), \end{aligned} \tag{8}$$

$$\begin{aligned} \tau_A^{sym1} &= 1 + \beta - \frac{\beta + \delta}{9 - 4\beta^2 - 4\delta^2 + 10\beta\delta}, \\ \tau_B^{sym1} &= 1 + \beta + \frac{\beta + \delta}{9 - 4\beta^2 - 4\delta^2 + 10\beta\delta}. \end{aligned} \tag{9}$$

Substituting the viewer and advertising prices into the viewer market shares (6) as well as into the advertising market shares (7), we find that

$$\begin{aligned} n_A^{v,sym1} &= \frac{1}{2} - \frac{3}{2(9 - 4\beta^2 - 4\delta^2 + 10\beta\delta)}, \quad n_B^{v,sym1} = 1 - n_A^{v,sym1} \\ n_A^{ad,sym1} &= \frac{1}{2} + \frac{2\beta - \delta}{2(9 - 4\beta^2 - 4\delta^2 + 10\beta\delta)}, \quad n_B^{ad,sym1} = 1 - n_A^{ad,sym1}. \end{aligned} \tag{10}$$

We then insert the equilibrium prices and quantities on both markets into equation (1) and obtain the following profits:

$$\begin{aligned} \Pi_A^{sym1} &= \frac{1}{8}\left(5 - 4(\delta - \beta) - \frac{1 - 4\delta - 2\beta(2 + 2\beta - \delta)}{9 - 4\beta^2 - 4\delta^2 + 10\beta\delta}\right), \\ \Pi_B^{sym1} &= \frac{1}{8}\left(7 - 4(\delta - \beta) + \frac{5 - 4\delta - 2\beta(2 + 2\beta - \delta)}{9 - 4\beta^2 - 4\delta^2 + 10\beta\delta}\right). \end{aligned} \tag{11}$$

Finally, we compute welfare as measured by total surplus:

$$W = \Pi_A + \Pi_B + \int_0^{n_A^v} u_{v,A} dv + \int_{1-n_B^v}^1 u_{v,B} dv + \int_0^{n_A^{ad}} \pi_{\gamma,A} d\gamma + \int_{1-n_B^{ad}}^1 \pi_{\gamma,B} d\gamma.$$

Inserting the equilibrium prices and quantities yields

$$\begin{aligned} W^{sym1} &= \frac{1}{16}\left(2 + 8(\delta - \beta) + \frac{3 + 16(\beta + \delta)}{9 - 4\beta^2 - 4\delta^2 + 10\beta\delta} + \frac{9(7 + 2\beta(\delta - 2\beta))}{(9 - 4\beta^2 - 4\delta^2 + 10\beta\delta)^2}\right) \\ &\quad + \bar{a} + \bar{u}. \end{aligned} \tag{12}$$

[7] Throughout, we used a mathematical software to conduct the straightforward but tedious calculations. The respective files will be provided upon request.

*4.2 Symmetric advertising with market abstention (*sym2*)*

In the second stage of the game with market abstention of advertisers in the center of the distribution, advertiser $\hat{\gamma}_j$ will be indifferent between advertising on channel $j \in \{A, B\}$ and not advertising at all if $\pi_{\hat{\gamma}_j,j} = 0$. Using (3) and $\bar{a} = 0$, this is equivalent to

$$\delta n_j^v - \tau_j - |\hat{\gamma}_j - x_j| = 0,$$

yielding the following demands for advertising:

$$n_A^{ad} = \delta n_A^v - \tau_A, \quad n_B^{ad} = \delta n_B^v - \tau_B. \tag{13}$$

The indifferent viewer is still characterized by equation (5). Substituting (13) in (5), we find that viewers' demands are, again, given by (6).

Taking into account that the viewers' and advertisers' demands are now given by equations (6) and (13), the analysis of the broadcasters' pricing decisions in the first stage of the game proceeds analogously to the previous section and yields the following results: The equilibrium prices equal

$$\begin{aligned}
p_A^{sym2} &= \frac{1}{4}(2 - \beta^2 - \delta^2 + 4\beta\delta)\frac{2 + 3\beta\delta - \delta^2}{3 - \beta^2 - \delta^2 + 4\beta\delta}, \\
p_B^{sym2} &= \frac{1}{4}(4 - \beta^2 - \delta^2 + 4\beta\delta)\frac{2 + 3\beta\delta - \delta^2}{3 - \beta^2 - \delta^2 + 4\beta\delta}, \\
\tau_A^{sym2} &= \frac{1}{4}(2 - \beta^2 - \delta^2 + 4\beta\delta)\frac{\beta + \delta}{3 - \beta^2 - \delta^2 + 4\beta\delta}, \\
\tau_B^{sym2} &= \frac{1}{4}(4 - \beta^2 - \delta^2 + 4\beta\delta)\frac{\beta + \delta}{3 - \beta^2 - \delta^2 + 4\beta\delta}.
\end{aligned} \tag{14}$$

The corresponding market shares are

$$\begin{aligned}
n_A^{v,sym2} &= \frac{1}{2}\left(1 - \frac{1}{3 - \beta^2 - \delta^2 + 4\beta\delta}\right), \\
n_B^{v,sym2} &= \frac{1}{2}\left(1 + \frac{1}{3 - \beta^2 - \delta^2 + 4\beta\delta}\right), \\
n_A^{ad,sym2} &= \frac{1}{4}\left(\delta - \beta - \frac{\delta - \beta}{3 - \beta^2 - \delta^2 + 4\beta\delta}\right), \\
n_B^{ad,sym2} &= \frac{1}{4}\left(\delta - \beta + \frac{\delta - \beta}{3 - \beta^2 - \delta^2 + 4\beta\delta}\right).
\end{aligned} \tag{15}$$

The equilibrium profits of the broadcasters equal

$$\begin{aligned}\Pi_A^{sym2} &= \frac{1}{16}(2-\beta^2-\delta^2+4\beta\delta)^2\frac{4-\beta^2-\delta^2+6\beta\delta}{(3-\beta^2-\delta^2+4\beta\delta)^2},\\ \Pi_B^{sym2} &= \frac{1}{16}(4-\beta^2-\delta^2+4\beta\delta)^2\frac{4-\beta^2-\delta^2+6\beta\delta}{(3-\beta^2-\delta^2+4\beta\delta)^2}.\end{aligned} \tag{16}$$

Finally, equilibrium welfare equals

$$\begin{aligned}W^{sym2} &= \frac{1}{16}\left(3(2-2\beta\delta+\beta^2+\delta^2)+\frac{1}{3-\beta^2-\delta^2+4\beta\delta}+\frac{7+6\beta\delta}{(3-\beta^2-\delta^2+4\beta\delta)^2}\right)\\ &\quad +\bar{u}.\end{aligned} \tag{17}$$

These results provide an equal ground for comparing the symmetric case to the asymmetric case of the following subsection, where market abstention of advertisers arises because of an advertising ban.

*4.3 Asymmetric advertising with an advertising ban on broadcaster B (*asym*)*

In the second stage of the game with an advertising ban on broadcaster B, advertiser $\hat{\gamma}_A$ will be indifferent between advertising on channel A and not advertising at all if $\pi_{\hat{\gamma}_A,A} = 0$. As in the previous section, this yields the following demand for advertising on platform A:

$$n_A^{ad} = \delta n_A^v - \tau_A. \tag{18}$$

The indifferent viewer is again characterized by equation (5). Inserting (18) and $n_B^{ad} = 0$ into equation (5), we find that viewers' demands equal

$$n_A^v = \frac{\beta\tau_A - p_A + p_B}{1+\beta\delta}, \quad n_B^v = 1 - n_A^v. \tag{19}$$

Taking into account that the viewers' and advertisers' demands are now given by equations (18) and (19), the analysis of the broadcasters' pricing decisions in the first stage of the game proceeds analogously to the previous sections and yields the following results: The equilibrium prices equal

$$\begin{aligned}p_A^{asym} &= (2-\delta(\delta-\beta))\frac{1+\beta\delta}{6-\beta^2-\delta^2+4\beta\delta},\\ p_B^{asym} &= (4-(\delta-\beta)^2)\frac{1+\beta\delta}{6-\beta^2-\delta^2+4\beta\delta},\\ \tau_A^{asym} &= (\delta+\beta)\frac{1+\beta\delta}{6-\beta^2-\delta^2+4\beta\delta}.\end{aligned} \tag{20}$$

The corresponding market shares are

$$
\begin{aligned}
n_A^{v,asym} &= \frac{2+2\beta\delta}{6-\beta^2-\delta^2+4\beta\delta}, \\
n_B^{v,asym} &= \frac{4-\beta^2-\delta^2+2\beta\delta}{6-\beta^2-\delta^2+4\beta\delta}, \\
n_A^{ad,asym} &= (\delta-\beta)\frac{1+\beta\delta}{6-\beta^2-\delta^2+4\beta\delta}.
\end{aligned} \tag{21}
$$

The equilibrium profits of the broadcasters equal

$$
\begin{aligned}
\Pi_A^{asym} &= \frac{(1+\beta\delta)^2(4-(\delta-\beta)^2)}{(6-\beta^2-\delta^2+4\beta\delta)^2}, \\
\Pi_B^{asym} &= \frac{(1+\beta\delta)(4-(\delta-\beta)^2)^2}{(6-\beta^2-\delta^2+4\beta\delta)^2}.
\end{aligned} \tag{22}
$$

Finally, equilibrium welfare equals

$$
\begin{aligned}
W^{asym} &= \frac{32-9\delta^2+\delta^4+2\beta\delta(17-\delta^2)+\beta^4(1+3\delta^2)-2\beta^3(\delta+3\delta^3)-\beta^2(9-2\delta^2-3\delta^4)}{2(6-\beta^2-\delta^2+4\beta\delta)^2} \\
&\quad +\bar{u}.
\end{aligned} \tag{23}
$$

4.4 Characterization of the equilibria

We now use the results derived so far to compare the equilibrium values for broadcasters A and B within the three regimes.

Proposition 1. *For all $\beta \in (0,1]$ and $\delta \in (0,1]$ with $\delta > \beta$, in equilibrium*

(a) broadcaster B has higher overall profits, sets higher prices on the viewer market and serves a larger part of it than broadcaster A in all regimes;

(b) broadcaster B sets higher prices on the advertising market than broadcaster A in the symmetric regimes;

(c) broadcaster B has larger advertising market shares than broadcaster A under regime sym2 with market abstention, but may have lower market shares under regime sym1.

PROOF: Follows from comparing equations (8)-(11) for *sym1*, (14)-(16) for *sym2*, and (20)-(22) for *asym* □

Table 1: Comparison within regimes

Regime	Sym1	Sym2	Asym
Viewer prices	$p_A < p_B$	$p_A < p_B$	$p_A < p_B$
Ad prices	$\tau_A < \tau_B$	$\tau_A < \tau_B$	$(\tau_A > 0)$
Number viewers	$n_A^v < n_B^v$	$n_A^v < n_B^v$	$n_A^v < n_B^v$
Number ads	$n_A^{ad} \gtreqless n_B^{ad}$	$n_A^{ad} < n_B^{ad}$	$(n_A^{ad} > 0)$
Profits	$\Pi_A < \Pi_B$	$\Pi_A < \Pi_B$	$\Pi_A < \Pi_B$

Note: In this table, we compare equilibrium values of both broadcasters in each regime. The symmetric model without market abstention (regime *sym1*) is shown in the first column, the symmetric model with market abstention (regime *sym2*) in the second column, and the asymmetric model (regime *asym*) in the third column.

The results of Proposition 1 are summarized in Table 1. As known from textbook models dealing with vertical product differentiation in one sided markets, selling the high quality product is an advantage that allows for higher prices and leads to higher profits.[8] In the otherwise symmetric regimes of our model, the advantage of medium B offering high quality content to consumers is carrying over from the viewer market to the advertiser market. As all consumers prefer high over low quality, the high quality medium B ceteris paribus attracts more viewers and thereby more advertisers, too. Consequently, B is able to set higher prices than the low quality medium A on both markets and earns higher overall profits.[9]

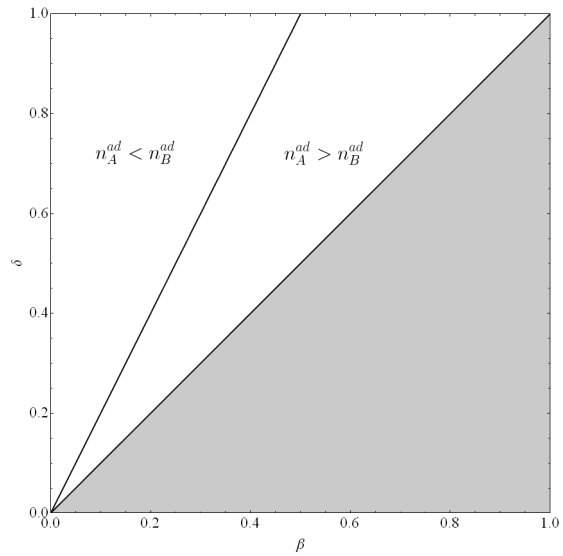
The effect of higher prices decreasing B's market shares on both markets is of second order. However, losing viewers further decreases B's share in the advertising market. If there is no market abstention on the advertising market (regime *sym1*), A benefits from B's loss. In this case, B may serve a smaller share of the advertising market than A despite its quality advantage. As Figure 2 shows, such a situation

[8]Hence, in a model with endogenous choice of quality, a Nash equilibrium with maximum vertical differentiation emerges only as the solution of a coordination game similar to the famous *Battle of the Sexes*.

[9]Note that the results with respect to profit levels are partly driven by the assumption that there are no quality costs in our framework.

is the more likely the smaller the positive viewer externality δ and the higher the nuisance cost β, because B serves the larger part of the viewer market.

Figure 2: Ad demand in regime *sym1*



Note: This figure illustrates the demand for advertising space in the equilibrium of the symmetric model without market abstention (regime *sym1*).

5 The role of the externalities

In this section, we conduct a comparative statics analysis with respect to the strength of the externalities between the two sides of the market.

5.1 Effects of an increase in the negative externality β

We first analyze the impact of a marginal increase in the nuisance parameter, i.e. the negative externality of advertising on viewer utility.

Proposition 2. *As the size of the negative externality β increases marginally, the equilibrium values evolve as depicted in Table 2. In particular, under all regimes*

(a) both broadcasters earn higher profits,

(b) welfare decreases.

PROOF: Follows from evaluating the partial derivatives of the equilibrium values (as given in equations (8) to (11) for regime *sym1*, (14) to (16) for regime *sym2*, and (20) to (22) for regime *asym*) with respect to β. □

Table 2: Comparative statics w.r.t. the negative externality β

Regime	Sym1		Sym2		Asym	
Broadcaster	A	B	A	B	A	B
Viewer prices	$\frac{\partial p_A}{\partial \beta} < 0$	$\frac{\partial p_B}{\partial \beta} > 0$	$\frac{\partial p_A}{\partial \beta} > 0$	$\frac{\partial p_B}{\partial \beta} > 0$	$\frac{\partial p_A}{\partial \beta} > 0$	$\frac{\partial p_B}{\partial \beta} > 0$
Ad prices	$\frac{\partial \tau_A}{\partial \beta} > 0$	$\frac{\partial \tau_B}{\partial \beta} > 0$	$\frac{\partial \tau_A}{\partial \beta} > 0$	$\frac{\partial \tau_B}{\partial \beta} > 0$	$\frac{\partial \tau_A}{\partial \beta} > 0$	
Number viewers	$\frac{\partial n_A^v}{\partial \beta} > 0$	$\frac{\partial n_B^v}{\partial \beta} < 0$	$\frac{\partial n_A^v}{\partial \beta} > 0$	$\frac{\partial n_B^v}{\partial \beta} < 0$	$\frac{\partial n_A^v}{\partial \beta} > 0$	$\frac{\partial n_B^v}{\partial \beta} < 0$
Number ads	$\frac{\partial n_A^{ad}}{\partial \beta} > 0$	$\frac{\partial n_B^{ad}}{\partial \beta} < 0$	$\frac{\partial n_A^{ad}}{\partial \beta} \gtreqless 0$	$\frac{\partial n_B^{ad}}{\partial \beta} < 0$	$\frac{\partial n_A^{ad}}{\partial \beta} < 0$	
Profits	$\frac{\partial \Pi_A}{\partial \beta} > 0$	$\frac{\partial \Pi_B}{\partial \beta} > 0$	$\frac{\partial \Pi_A}{\partial \beta} > 0$	$\frac{\partial \Pi_B}{\partial \beta} > 0$	$\frac{\partial \Pi_A}{\partial \beta} > 0$	$\frac{\partial \Pi_B}{\partial \beta} > 0$
Welfare	$\frac{\partial W}{\partial \beta} < 0$		$\frac{\partial W}{\partial \beta} < 0$		$\frac{\partial W}{\partial \beta} < 0$	

Note: This table illustrates the effects of a marginal increase in the size of the negative externality on consumer utility, β. We depict the effects on equilibrium values of each broadcaster in each regime. The symmetric model without market abstention (regime *sym1*) is shown in the first column, the symmetric model with market abstention (regime *sym2*) in the second column, and the asymmetric model (regime *asym*) in the third column.

In order to gain some intuition for the results, notice that an increase in the nuisance cost β increases the relative importance of few advertisements but decreases the relative importance of low viewer prices when viewers decide which program to watch. Hence, competing for viewers, broadcasters now have stronger incentives to reduce the number of advertisements but weaker incentives to set low viewer prices. Put differently, since viewers do not abstain from the market by assumption, stronger nuisance relaxes price competition on both sides of the market. On the one hand, broadcasters will increase their advertisement prices in order to reduce the number of advertisements. On the other hand, relaxed competition for viewers tends to increase viewer prices, too. Thus, the profits of the broadcasters increase.[10]

[10]Reisinger (2012, Proposition 2) points to the possibility that increasing nuisance may raise the

The fact that increasing nuisance raises broadcasters' profits but, not surprisingly, reduces welfare establishes a conflict between private and social objectives. This trade-off calls for regulation in order to limit the nuisance caused by advertisements and may thus explain the various rules concerning advertisement on television discussed in the introduction.

Due to the relaxed competition for viewers, viewer prices increase in fact under all regimes at both stations with one exception: Under regime *sym1*, without abstention from the advertising market, the identity of the marginal advertiser shifts such that more advertisers opt for the cheaper medium A (cf. Figure 2). Since more advertisement induces viewers to switch to platform B, broadcaster A will lower its viewer price in order to countervail this effect.

Under regimes *sym2* and *asym*, the marginal advertiser is indifferent between advertising on a certain channel and abstaining from the market. Therefore, a rising advertising price ceteris paribus makes him leave the market. This is the intuition for the finding that advertising market shares decrease for broadcaster A under regime *asym* and broadcaster B under regime *sym2*. By the same logic, the advertising market share of broadcaster A, too, decreases for virtually the whole parameter range under regime *sym2*.[11]

Moreover, starting from equilibrium and increasing β, the previously marginal viewer will now, ceteris paribus, switch to the channel with the smaller number of advertisements. However, as we have seen in the previous section (cf. Table 1), the channel with the smaller number of advertisements will be broadcaster A under regime *sym2* for the whole range of parameters, but under regime *sym1* if and only if β is sufficiently small compared to δ. Nevertheless, broadcaster A gains market shares at the expense of broadcaster B for the whole range of parameters due to the movements of the viewer prices. Under regime *asym*, the channel with the smaller number of advertisements is channel B facing the advertising ban. However, the direct effect of stronger nuisance on channel A is outweighed by broadcaster A's reduction in the number of his advertisements due to a higher advertisement price.

5.2 Effects of an increase in the positive externality δ

We now examine how an increase in the effectiveness of advertisements, i.e. the positive externality the number of viewers exerts on advertisers' profits, affects the equilibrium.

Proposition 3. *As the size of the positive externality δ increases marginally, the equilibrium values evolve as depicted in Table 3. In particular,*

profits of the platforms under the assumption of homogeneous advertisers and zero viewer prices. Assuming heterogeneous advertisers and allowing for positive viewer prices, we sharpen his result.

[11] The possibility of a rising advertising market share of broadcaster A under regime *sym2* is due to an increase of his viewer market share countervailing the rising advertising price.

(a) *the profits of the broadcasters decrease under regime* sym1 *but may increase under regimes* sym2 *and* asym.

(b) *welfare increases under regime* sym1 *but may decrease under regimes* sym2 *and* asym.

PROOF: Follows from evaluating the partial derivatives of the equilibrium values (as given in equations (8) to (11) for regime *sym1*, (14) to (16) for regime *sym2*, and (20) to (22) for regime *asym*) with respect to δ. □

Table 3: Comparative statics w.r.t. the positive externality δ

Regime	Sym1		Sym2		Asym	
Broadcaster	A	B	A	B	A	B
Viewer prices	$\frac{\partial p_A}{\partial \delta} < 0$	$\frac{\partial p_B}{\partial \delta} < 0$	$\frac{\partial p_A}{\partial \delta} \gtreqless 0$	$\frac{\partial p_B}{\partial \delta} \gtreqless 0$	$\frac{\partial p_A}{\partial \delta} \gtreqless 0$	$\frac{\partial p_B}{\partial \delta} \gtreqless 0$
Ad prices	$\frac{\partial \tau_A}{\partial \delta} < 0$	$\frac{\partial \tau_B}{\partial \delta} > 0$	$\frac{\partial \tau_A}{\partial \delta} > 0$	$\frac{\partial \tau_B}{\partial \delta} > 0$	$\frac{\partial \tau_A}{\partial \delta} > 0$	
Number viewers	$\frac{\partial n_A^v}{\partial \delta} \gtreqless 0$	$\frac{\partial n_B^v}{\partial \delta} \gtreqless 0$	$\frac{\partial n_A^v}{\partial \delta} \gtreqless 0$	$\frac{\partial n_B^v}{\partial \delta} \gtreqless 0$	$\frac{\partial n_A^v}{\partial \delta} > 0$	$\frac{\partial n_B^v}{\partial \delta} < 0$
Number ads	$\frac{\partial n_A^{ad}}{\partial \delta} < 0$	$\frac{\partial n_B^{ad}}{\partial \delta} > 0$	$\frac{\partial n_A^{ad}}{\partial \delta} > 0$	$\frac{\partial n_B^{ad}}{\partial \delta} > 0$	$\frac{\partial n_A^{ad}}{\partial \delta} > 0$	
Profits	$\frac{\partial \Pi_A}{\partial \delta} < 0$	$\frac{\partial \Pi_B}{\partial \delta} < 0$	$\frac{\partial \Pi_A}{\partial \delta} \gtreqless 0$	$\frac{\partial \Pi_B}{\partial \delta} \gtreqless 0$	$\frac{\partial \Pi_A}{\partial \delta} > 0$	$\frac{\partial \Pi_B}{\partial \delta} \gtreqless 0$
Welfare	$\frac{\partial W}{\partial \beta} > 0$		$\frac{\partial W}{\partial \beta} \gtreqless 0$		$\frac{\partial W}{\partial \beta} \gtreqless 0$	

Note: This table illustrates the effects of a marginal increase in the size of the positive externality the number of viewers exerts on advertisers' profits, δ. We depict the effects on equilibrium values of each broadcaster in each regime. The symmetric model without market abstention (regime *sym1*) is shown in the first column, the symmetric model with market abstention (regime *sym2*) in the second column, and the asymmetric model (regime *asym*) in the third column.

In order to gain some intuition for the results, notice that an increase in the effectiveness of advertisements δ increases the relative importance of the number of viewers but decreases the relative importance of low ad prices when firms decide about advertising. Hence, competing for advertisers, broadcasters now have stronger incentives to increase the number of viewers but weaker incentives to set low ad

prices. Put differently, as price competition weakens in the advertising market but intensifies in the viewer market, we observe two opposing effects on profits.

Under regime *sym1* where the advertising market is fully covered, broadcasters cannot attract new advertisers but have to steal them from their rivals. Starting from equilibrium and increasing δ, the previously marginal advertiser will now, ceteris paribus, switch to the channel with the larger number of viewers which puts further pressure on the viewer prices.[12] The effect of weaker competition on the advertising market is, thus, less pronounced than the effect of stronger competition on the viewer market. Consequently, the broadcasters' profits decrease.

By contrast, under regimes *sym2* and *asym* with abstention from the advertising market, the previously marginal advertisers will now find it profitable to advertise. Hence, all respective advertising market shares increase due to new advertisers. Without a business-stealing effect on the advertising market, pressure on viewer prices is less pronounced. The overall effect on the broadcaster's profits will then depend on the nuisance parameter β. Remember from the last section that nuisance relaxes competition on both sides of the market. Hence, for increasing δ, broadcasters will earn higher profits and even be able to increase their viewer prices if the nuisance parameter β is sufficiently large. The exact relationships are depicted in the upper panels of Figure 3 for regime *sym2*; they look similar for regime *asym*.

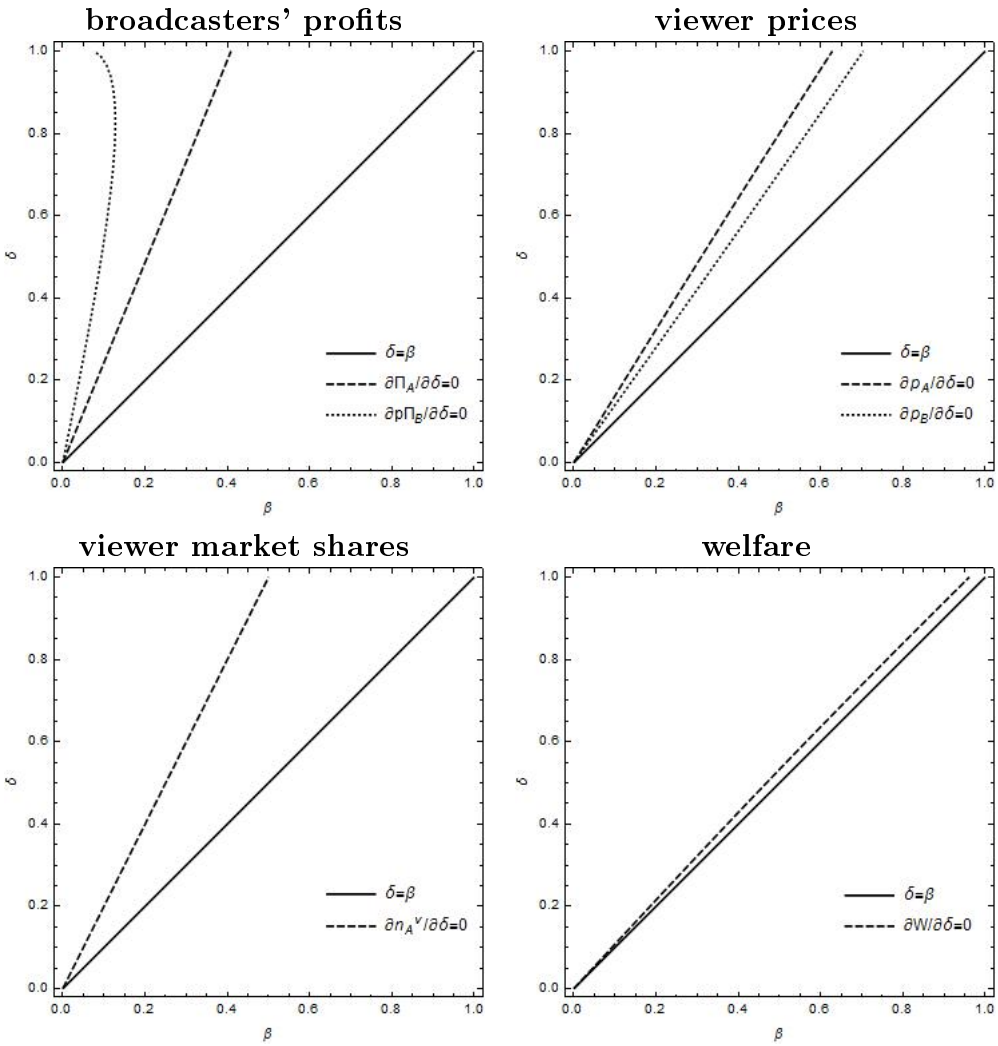
Remember that a rise in the positive externality δ increases the effectiveness of informative advertisement.[13] Thus, ceteris paribus, the advertising firms will earn higher profits while neither broadcasters nor viewers will be affected if δ increases. If the initial allocation was efficient, a rise in δ would, therefore, always increase welfare. Our results show, however, that such reasoning does not have to hold when broadcasters compete for viewers and advertisers. Instead, if the advertising market is not fully covered, i.e. under regimes *sym2* and *asym*, and the nuisance parameter β is sufficiently high, a rise in the positive externality δ will decrease welfare. In such a situation, not only advertisers profit from an increase in δ but also broadcasters, as just argued (cf. upper left panel of Figure 3). Notice, however, that viewers suffer in three ways. First, they face more nuisance from advertisements as more firms advertise. Second, as just argued, they face higher viewer prices (cf. upper right panel of Figure 3). Third, the average quality of the consumed program decreases as more viewers join the low quality platform A.[14] The viewers' loss of utility may thus exceed the additional profits of advertisers and broadcasters. The exact

[12] As we have seen in Table 1, the channel with the larger number of viewers is broadcaster B. Hence, channel B gains shares in the ad market at the expense of channel A.

[13] For instance, consider innovations in information technologies that improve the individual reception of advertisements.

[14] This holds true for the whole range of parameters under regime *asym*, and for β sufficiently large under regime *sym2* (cf. lower left panel of Figure 3). Therefore, the range of parameters for which welfare decreases due to an increase in δ is even larger under regime *asym* than under regime *sym2*.

Figure 3: Ambiguous effects of an increase in δ under regime *sym2*



Note: This figure illustrates the ambiguous effects of an increase in δ under regime *sym2*. To the lower right of the respective dashed (dotted) lines, the profit of broadcaster A (B) increases (upper left panel), the viewer price of broadcaster A (B) increases (upper right panel), the viewer market share of broadcaster A increases (lower left panel), and welfare decreases (lower right panel).

relationship is depicted in the lower right panel of Figure 3 for regime *sym2*; it looks similar for regime *asym*.

6 Effectiveness of an advertising ban

This section is devoted to evaluating the effectiveness of an advertising ban in the light of the two main objectives of this policy instrument. The first objective is an overall reduction of advertisements in the industry thereby also reducing the respective negative externality. The second objective is to make quality broadcasts more attractive to consumers which implies an increase in market shares of the quality medium.

Discussing type restrictions, we will focus on a ban on advertisements in the high quality medium. The opposite case of an advertising ban in the low quality medium is less realistic and therefore omitted. Technically speaking, in the following we compare the equilibrium values of the regimes *sym2* and *asym*.[15]

Proposition 4. *For all $\delta > \beta$, in equilibrium,*

(a) the overall amount of advertising is lower,

(b) the viewer market share of broadcaster A (B) is larger (smaller),

(c) the profit of broadcaster A may be higher,

(d) welfare is lower.

under regime asym *(i.e. with the advertising ban on the high quality medium B) than under regime* sym2 *(i.e. without the advertising ban).*

PROOF: Follows from comparing the respective equilibrium values as given by equations (14) to (16) for regime *sym2* and (20) to (22) for regime *asym*. □

Table 4 depicts the effects of an advertising ban on all equilibrium values. While the result concerning the reduction of the overall amount of advertising is intuitive, it may be surprising, at a first glance, that medium B loses viewers by reducing its advertising level to zero. However, to get an intuition for this finding, note that the incentives for attracting viewers (by low viewer prices) are twofold on a two-sided media market: First, there is a direct (positive) effect on demand in the viewer market. Second, there is an indirect (positive) effect on revenues from advertising due to the positive externality viewers exert on the demand of advertisers.

Being prevented from advertising, the high quality medium B loses this second motive while the incentives of medium A remain unchanged. Hence, compared

[15] For the comparison with *asym*, we choose *sym2* over *sym1* because regimes *sym2* and *asym* share the feature that $\bar{a} = 0$, i.e. the advertising market is not fully covered.

Table 4: Comparison across regimes (sym2 vs. asym)

Broadcaster	A	B
Viewer prices	$p_A^{sym2} \gtreqless p_A^{asym}$	$p_B^{sym2} \gtreqless p_B^{asym}$
Advertising prices	$\tau_A^{sym2} < \tau_A^{asym}$	
Viewer market shares	$n_A^{v,sym2} < n_A^{v,asym}$	$n_B^{v,sym2} > n_B^{v,asym}$
Advertising market shares	$n_A^{ad,sym2} + n_B^{ad,sym2} > n_A^{ad,asym}$	
Profits	$\Pi_A^{sym2} \gtreqless \Pi_A^{asym}$	$\Pi_B^{sym2} > \Pi_B^{asym}$
Welfare	$W^{sym2} > W^{asym}$	

Note: This table illustrates the effects of broadcaster B not being allowed to enter the advertising market by comparing the equilibria of the symmetric model with abstention (regime *sym2*) and the asymmetric model (regime *asym*).

to channel B, the relative incentives to attract viewers are stronger for channel A in the case of asymmetric advertising than in the case of symmetric advertising. Accordingly, the equilibrium shares of broadcaster A in the viewer market are bigger with the advertising ban than without.[16] Put differently, the advertising ban misses the target of increasing the reception of high quality content. Moreover, it also reduces welfare.

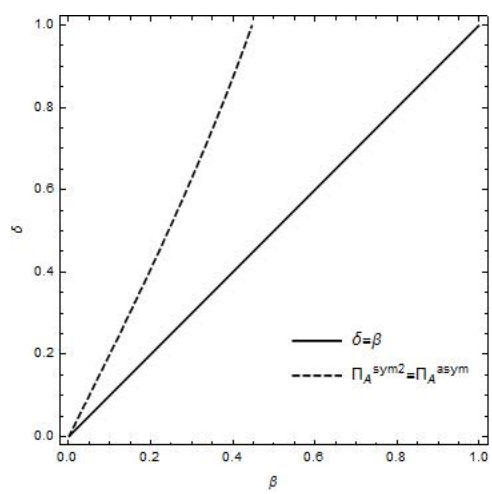
The evolution of viewer prices is governed by two opposing forces. On the one hand, channel A has an incentive to lower its viewer price in order to regain shares in the viewer market, since the *direct* effect of no advertising at channel B ceteris paribus increases the number of viewers at channel B. This affects both, revenues from viewers and revenues from advertisers. Since price competition on the viewer market increases, channel B's viewer prices are increasingly under pressure. On the other hand, the *indirect* effect of not being obliged to please any customers on the advertising market lowers channel B's incentive to attract viewers by low prices. This mitigates price competition on the viewer market and gives room for rising viewer prices, even to channel A. Whether the direct or indirect effect dominates

[16] At the same time, this increase in the number of viewers allows channel A to choose a higher advertising price.

the evolution of viewer prices depends on the relative strength of the externalities between the two sides of the market.

Being prevented from entering the advertising market obviously is a disadvantage for broadcaster B, lowering his profits. Moreover, the analysis shows that for any given value of δ, the fact that B is not allowed to enter the advertising market is beneficial for broadcaster A if and only if the nuisance cost β is sufficiently small. The stronger the nuisance β, the more pronounced the reduction in viewer prices must be in order to regain shares in the viewer market. Thus, for high β, the direct effect of the ban that intensifies price competition on the viewer market will dominate. The exact relationship is depicted in Figure 4. The fact that the low quality medium A may profit from the advertising ban on the high quality medium B helps to understand why private broadcasters usually oppose proposals to abolish type restrictions on advertisement (Reisinger, 2012). Such behavior cannot be explained by standard competitive bottleneck models of media markets without competition for advertisers (Anderson and Coate, 2005).

Figure 4: Comparison of broadcaster A's profits under *sym2* and *asym*



Note: This figure illustrates the effects an advertising ban on broadcaster B has on the equilibrium profits of broadcaster A by comparing the respective profits under regimes *sym2* and *asym*. To the upper left of the dashed line, the profit of broadcaster A increases due to the ban.

7 Concluding remarks

We have examined a two-sided markets model of two competing media outlets with maximum quality differentiation that offer content to ad-averse consumers and advertising space to advertisers where content quality is a feature of vertical differentiation on the viewer market and a feature of horizontal differentiation on the advertiser market. Conducting a comparative statics analysis, we have shown that broadcasters' profits increase and welfare decreases in the viewers' nuisance costs of advertising. Moreover, welfare may decrease in the effectiveness of informative advertisement as well. We then have compared two regimes in which either both media outlets (*sym2*) or only the low quality medium (*asym*) are allowed to enter the advertising market. Here, the main result is that, although viewers dislike advertisements, the high quality medium loses viewer market shares in equilibrium in the case where it does not carry advertisements.

We impose some strong assumptions to characterize the media market by assuming that all consumers prefer high quality over low quality, and that all consumers are ad-averse. This is to make sure that consumers ceteris paribus prefer high quality over low quality, and a small number of advertisements over a large number of advertisements. We show that even under such strict assumptions, the policy instrument of providing a high-quality-no-advertisement medium is not capable of increasing the demand for quality in the media.

One assumption of our analysis is that the levels of quality are exogenously fixed at maximum differentiation. In principle, the framework at hand also allows for modeling an endogenous decision on quality levels, though this is analytically hardly tractable. The results with exogenous levels of quality may, however, already give a hint on how these levels would react to a ban on advertising if the decision on quality was endogenous. As we have emphasized above, broadcaster B affected by this ban loses part of his incentives to attract viewers. With the quality of content being chosen endogenously, it is, besides viewer prices, a second instrument for attracting viewers. Accordingly, one might expect quality levels to evolve analogically to viewer prices: On the one hand, since the direct effect of no advertising at channel B ceteris paribus increases the number of viewers at channel B, channel A has an incentive to raise its quality level in order to regain shares in the viewer market. This intensifies competition in that market and puts pressure also on channel B's quality level. On the other hand, the indirect effect of not being obliged to please any customers on the advertising market lowers channel B's incentive to attract viewers by high quality. This mitigates competition in the viewer market and gives room for decreasing quality levels, even to channel A. Whether the direct or indirect effect dominates the evolution of quality levels should, again, depend on the relative strength of the externalities between the two markets. Such ambiguity is also in line with the related literature on endogenous product differentiation on the viewer

market (Gabszewicz et al., 2004, Peitz and Valletti, 2008).

Another assumption of our analysis is that broadcasters decide simultaneously on both, viewer prices and advertising prices. Alternatively, one might assume that both media outlets first simultaneously choose prices on the viewer market, and then – after observing the viewer prices – simultaneously choose prices on the advertising market. Such a sequential setting would account for the fact that advertising prices are usually changed more frequently than viewer prices. In a former version of this paper (Greiner and Sahm, 2011), we conduct the analogous analysis for this alternative game structure and find the qualitatively same results.

Given our findings, imposing a general ban for advertisements in public service broadcasting should be reconsidered. The more so as public service broadcasters have to be compensated for their revenue loss. In France, these transfers are paid by the public: Advertisements on commercial television are taxed to finance the revenue loss in public service broadcasting, which leads to additional distortions. Given that this policy instrument only partially yields the desired results, public financing of a television program that reaches less consumers than before may be an issue in need of further deliberation.

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