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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 stations 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. We analyze the impact of both the strength of mutual externalities and advertisement regulation policies on the viewers' equilibrium demand for high quality content. We find that, although consumers dislike advertisements, an advertising ban in the high quality medium reduces its viewer market share and thereby the equilibrium reception of high quality content.

JEL-Code: D210, L130, L510, L820.

Keywords: horizontal and vertical product differentiation, two-sided externalities, advertising ban.

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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),[3] 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 ads during a certain time of day.[4]

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[5]. A day and night advertising ban is currently under debate in France, and parliament is expected to decide on this issue after the general elections in 2012. This would turn the French system into a pure type restriction regime.

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

[3]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)

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

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

the number of viewers exerts a positive externality on advertisers, competition for advertisers intensifies competition for viewers. An advertising ban 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.

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 markets 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 or positive externality parameters affects the results. Finally, we evaluate the effectiveness of an advertising ban for 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 does not lead to more consumers watching the high quality program.

Besides these findings that are highly relevant for political decisions on the use of type restrictions on advertising, 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.[6] 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.

Literature overview

This paper builds on the two-sided market literature initially addressed by Rochet and Tirole (2003, 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 (2010) uses a similar framework to analyze competition for advertisers and consumers. In contrast to our analysis, he assumes media platforms to be homogenous for advertisers. However, the results with respect to the media outlets' profits that may increase in user nuisance from advertising are in line with our findings.
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 reaching a certain target 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 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

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

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.

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 robust results that hold even if the quality of the medium that is not allowed to carry ads is maximal (consumer utility is strictly increasing in quality which implies that demand for the quality medium without advertisements would be even lower if quality is lower).

The outline of the paper is as follows: Section 2 describes the model setup and the necessary assumptions. In Section 3 we analyze 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 for 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‘ profits, it is worthwhile analyzing the effects of an increase of the network effects which is what we do in Section 4. In Section 5, we analyze the effectiveness of an advertising ban in the light of reaching the policy goals of reducing the amount of advertisements, and making the quality broadcast more attractive to consumers. Section 6 concludes.

2 Model setup

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.

Broadcasters

Two broadcasters $j \in \{A, B\}$ compete for market shares in the advertising market n_j^{ad} offering advertising space and in the viewer market n_j^v 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 submarket. 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.

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 of advertisements n_j^{ad} 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 %.[7] We assume that the degree of ad-aversion is the same for all consumers. In the comparative statics part in Section 4, 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.

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 $\bar{a} = 0$.

[7] 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.

The number of consumers n_j^v 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 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, 2010): Advertisers are monopolists for the variety γ of the good they produce at zero marginal costs. Via 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 k for each producer's good equals 1.[8] 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 economically 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

[8] 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.

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.

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 three-stage game. In stage one, both media outlets first simultaneously choose prices on the viewer market and then, in stage two, simultaneously choose prices on the advertising market. This sequential setting accounts for the fact that advertising prices are changed more frequently than viewer prices.[9] In stage three, 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 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.

[9]Note that advertising prices are often determined with respect to market shares on the viewer market which are subject to fluctuations. Following the existing literature, e.g. Anderson and Coate (2005) or Peitz and Valletti (2008), advertising prices are fixed in our model, though.

3 Equilibria with and without regulation of advertisement

In this section, we derive the market equilibria that evolve 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*.

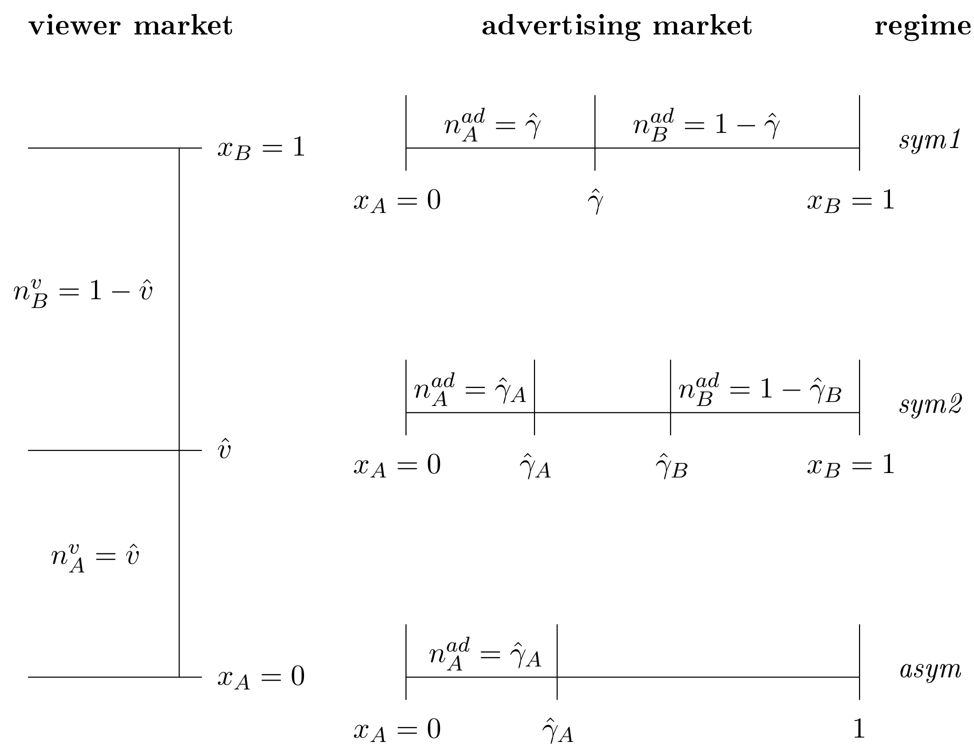
In the first case of symmetric advertising (*sym1*) we assume that the reputational gain from advertising $\bar{a}$ is sufficiently high to ensure market coverage. In this situation, all producers decide to advertise either on channel A or B which implies that the broadcasters' shares on the advertising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

In the second case of symmetric advertising (*sym2*) we allow for 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 more detail only for *sym1* and then just sketch it for the regimes *sym2* and *asym*.

3.1 Symmetric advertising without market abstention (*sym1*)

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

Advertiser $\hat{\gamma}$ is indifferent between placing his advertisement on channel A and B if the following condition holds:

$$\begin{aligned} \pi_A &= \pi_B \\ \Leftrightarrow \quad n_A^v - \tau_A - (\hat{\gamma} - x_A) &= \bar{a} + \delta n_B^v - \tau_B - (x_B - \hat{\gamma}) \,. \end{aligned} \tag{4}$$

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 channel B, the demand for advertisements in medium j is

$$\begin{aligned} n_A^{ad} &= \hat{\gamma} = \frac{\delta\left(n_A^v - n_B^v\right) - \tau_A + \tau_B + \left(x_A + x_B\right)}{2}, \\ n_B^{ad} &= 1 - n_A^{ad}. \end{aligned} \tag{5}$$

Viewer $\hat{v}$ is indifferent between watching channel A and B if the following condition holds:

$$\begin{aligned} u_A &= u_B \\ \Leftrightarrow \quad \bar{u} + \hat{v}x_A - \beta n_A^{ad} - p_A &= \bar{u} + \hat{v}x_B - \beta n_B^{ad} - p_B. \end{aligned} \tag{6}$$

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 (5) in (6), we obtain the viewers' demand for medium j:

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

Substituting these results into equations (5) yields

$$\begin{aligned} n_A^{ad} &= \frac{1 - \delta + 2\delta\left(p_B - p_A + \beta\right) - \tau_A + \tau_B}{2\left(1 + 2\beta\delta\right)}, \\ n_B^{ad} &= 1 - n_A^{ad}. \end{aligned} \tag{8}$$

In the first and second stage of the game, both broadcasters first simultaneously set their prices on the viewer market and then simultaneously set their prices on the advertising market anticipating the viewers' and advertisers' reactions. We take the results from equations (7) and (8), and substitute them into the profit function of broadcaster j as given by equation (1). Maximizing the broadcasters' profits with respect to the advertising prices τ_j, we obtain the following optimal prices:

$$\begin{aligned}\tau_A(p_A,p_B) &= 1-2\beta\delta+\frac{2\left[p_A(2\beta-\delta)+p_B(\beta+\delta)\right]-\delta}{3},\\ \tau_B(p_A,p_B) &= 1-2\beta\delta+\frac{2\left[p_B(2\beta-\delta)+p_A(\beta+\delta)\right]-\delta}{3}.\end{aligned}\tag{9}$$

We now substitute equations (9) into the profit function (1) which then is maximized with respect to p_j. This yields the following viewer prices:

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

where $\Delta^{sym1}\equiv 27-8\beta^2+38\beta\delta-8\delta^2$.

The advertising prices are obtained by substituting these viewer prices in equations (9) which yields

$$\begin{aligned}\tau_A^{sym1} &= 1+\frac{5\beta}{4}+\frac{2\beta(\beta+\delta)}{3}-\frac{12\delta+\beta\left(39-8\beta^2+46\beta\delta\right)}{4\Delta^{sym1}},\\ \tau_B^{sym1} &= 1+\frac{3\beta}{4}+\frac{2\beta(\beta+\delta)}{3}+\frac{12\delta+\beta\left(39-8\beta^2+46\beta\delta\right)}{4\Delta^{sym1}}.\end{aligned}\tag{11}$$

Substituting the viewer and advertising prices into the viewer market shares (7) as well as into the advertising market shares (8), we find that

$$\begin{aligned}n_A^{v,sym1} &= \frac{1}{2}-\frac{9+4\beta(\beta+\delta)}{2\Delta^{sym1}}, & n_B^{v,sym1} &= \frac{1}{2}+\frac{9+4\beta(\beta+\delta)}{2\Delta^{sym1}},\\ n_A^{ad,sym1} &= \frac{1}{2}+\frac{3(2\beta-\delta)}{2\Delta^{sym1}}, & n_B^{ad,sym1} &= \frac{1}{2}-\frac{3(2\beta-\delta)}{2\Delta^{sym1}}.\end{aligned}\tag{12}$$

Note again that the decision where to place an advertisement is not only driven by the advertising price but also by the inherent product characteristics of the good the advertiser intends to market.

We substitute the equilibrium prices and quantities on both markets into equation (1) in order to obtain the following profits:

$$\Pi_A^{sym1} = \frac{5}{8} + \frac{\beta(9+4\beta)}{12} + \frac{\delta(\beta-1)}{3} - \Phi^{sym1},$$
$$\Pi_B^{sym1} = \frac{7}{8} + \frac{\beta(7+4\beta)}{12} + \frac{\delta(\beta-1)}{3} - \Phi^{sym1}, \tag{13}$$

where $\Phi^{sym1} \equiv \frac{1}{96}\left[\frac{27\left[8\beta^4-18-43\beta^2-10\beta\delta\left(4+7\beta^2\right)\right]}{(\Delta^{sym1})^2} + \frac{3\left[18+36\beta(2+\delta)+\beta^2(80\delta-23-64\beta)\right]}{\Delta^{sym1}}\right].$

3.2 Symmetric advertising with market abstention (*sym2*)

Regime *sym2* considers the case in which $\bar{a} = 0$ implying that there are no profit-increasing repuational effects from advertising per se. In this case, advertisers from the center of the distribution who have to incur high transportation costs due to the media outlets being located at either $x_A = 0$ or $x_B = 1$ prefer not to enter the market. Put differently, regime *sym2* describes a situation where market abstention of advertisers arises in equilibrium.

The derivation of the equilibrium is along the line of the previous subsection. As the results do not vary qualitatively from those obtained above, the mathematical solution to this subsection can be found in the Appendix. The 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.

3.3 Asymmetric advertising with an advertising ban for broadcaster B (*asym*)

Under regime *asym*, only the low quality medium is allowed to enter the advertising market. In the first stage of the game, first both broadcasters set prices on the viewer market and then, in the second stage, broadcaster A decides how high an advertising price he sets. In the third stage, advertisers decide whether to enter the advertising market by placing their advertisement in broadcast A or abstain from advertising, and viewers decide which channel to watch. Again, there is no additional gain from advertisement, i.e. $\bar{a} = 0$.

The marginal advertiser $\hat{\gamma}_A$ is indifferent between advertising on channel A and abstaining from advertising if

$$\begin{aligned} \pi_A &= 0 \\ \Leftrightarrow \quad & \delta n_A^v - \tau_A - (\hat{\gamma}_A - x_A) = 0, \end{aligned} \tag{14}$$

with $x_A = 0$. Accordingly, the fraction of of advertisers placing their advertisement in broadcast A is given by

$$n_A^{ad} = \hat{\gamma}_A = \delta n_A^v - \tau_A. \tag{15}$$

Inserting (15) and $n_B^{ad} = 0$ into equation (6), and solving for the the market share of medium A on the viewer market, we obtain

$$\begin{aligned} n_A^v(p_A, p_B, \tau_A) &= \hat{v} = \frac{\beta\tau_A - p_A + p_B}{1 + \beta\delta}, \\ n_B^v(p_A, p_B, \tau_A) &= 1 - n_A^v = \frac{1 + \beta(\delta - \tau_A) + p_A - p_B}{1 + \beta\delta}. \end{aligned} \tag{16}$$

Plugging these results into the profit function (1) of broadcaster A and maximizing it with respect to the optimal advertising price τ_A yields

$$\tau_A(p_A, p_B) = \frac{(\beta - \delta) p_A + \delta p_B}{2}. \tag{17}$$

We insert (17) in the profit function (1), maximize it with respect to the prices, and obtain the following results:

$$\begin{aligned} p_A^{asym} &= \frac{2(1 + \beta\delta)[2 - (\delta - \beta)\delta]}{\Delta^{asym}}, \qquad p_B^{asym} = \frac{2(1 + \beta\delta)\left[4 - (\beta - \delta)^2\right]}{\Delta^{asym}}, \\ \tau_A^{asym} &= \frac{2(1 + \beta\delta)(\beta + \delta)}{\Delta^{asym}}, \end{aligned} \tag{18}$$

where $\Delta^{asym} \equiv \beta\delta\left(12 - \beta^2 - \delta^2\right) - 2\left[\delta^2 - \beta^2\left(\delta^2 - 1\right) - 6\right]$.

This yields the following market shares:

$$n_A^{v,asym} = \frac{4\left(1+\beta\delta\right)}{\Delta^{asym}}, \qquad n_B^{v,asym} = 1 - \frac{4\left(1+\beta\delta\right)}{\Delta^{asym}},$$
$$n_A^{ad,asym} = \frac{2\left(1+\beta\delta\right)\left(\delta-\beta\right)}{\Delta^{asym}}. \tag{19}$$

With these results we are able to compute the profits of the broadcasters:

$$\Pi_A^{asym} = \frac{4\left[4-\left(\beta-\delta\right)^2\right]\left(1+\beta\delta\right)^2}{\left(\Delta^{asym}\right)^2},$$
$$\Pi_B^{asym} = \frac{2\left[\left(\beta-\delta\right)^2-4\right]^2\left(1+\beta\delta\right)\left(2+\beta\delta\right)}{\left(\Delta^{asym}\right)^2}. \tag{20}$$

3.4 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*

1. *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.*
2. *broadcaster B sets higher prices on the advertising market than broadcaster A in the symmetric regimes.*
3. *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 (10)-(13) for *sym1*, (22)-(24) (Appendix) for *sym2*, and (18)-(20) for *asym* □

The results of Proposition 1 are summarized in Table 1.

Table 1: Comparison within regimes

Regime:	Sym1	Sym2	Asym
Viewer prices	$p_A < p_B$	$p_A < p_B$	$p_A < p_B$
Advertising prices	$\tau_A < \tau_B$	$\tau_A < \tau_B$	$(\tau_A > 0)$
Viewer market shares	$n_A^v < n_B^v$	$n_A^v < n_B^v$	$n_A^v < n_B^v$
Advertising market shares	$n_A^{ad} \gtreqless n_B^{ad}$	$n_A^{ad} < n_B^{ad}$	$(n_A^{ad} > 0)$
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.

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.[10]

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.[11]

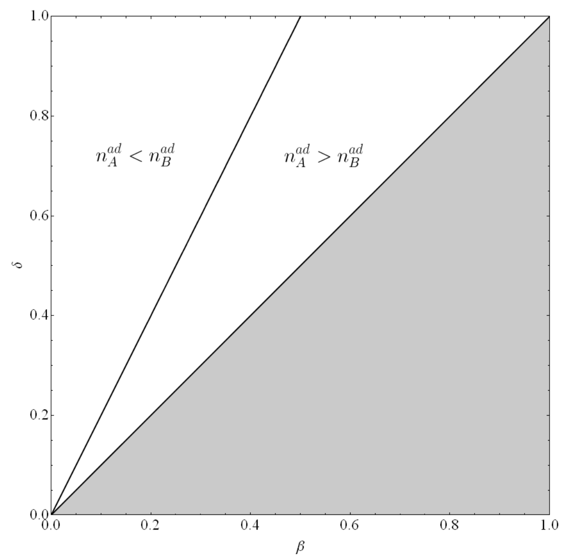
The effect of higher prices decreasing B's market shares on both markets is of second order. However, losing viewers further decreases B's share in the advertising market. If there is no market abstention on the advertising market (regime *sym1*), A benefits from B's loss. In this case, B may serve a smaller share of the advertising market than A despite its quality advantage. As Figure 1 shows, such a situation is the more likely to occur the

[10]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*.

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

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*).

4 The role of the externalities

In this section, we conduct a comparative statics analysis with respect to the strength of the externalities arising in this two-sided market. We first analyze the impact of an increase in the nuisance parameter, i.e. the negative externality of advertising on viewer utility. Then we examine how an increase in the positive externality the number of viewers exerts on advertisers' profits affects the equilibrium.

4.1 Effects of an increase in the negative externality β

Proposition 2. *As the size of the negative externality β increases, the equilibrium values evolve as follows:*

1. Prices and profits: *In all three regimes, both broadcasters set higher prices on both markets (where possible) and earn higher profits.*

2. Advertising market shares: *Under regime* sym1*, broadcaster A gains market shares at the expense of broadcaster B.*

   Under regime sym2*, broadcaster B loses market shares while the effects are ambiguous for broadcaster A.*

   Under regime asym*, broadcaster A loses market shares.*

3. Viewer market shares: *Under regime* sym1*, for any given* $\delta \in (0,1]$ *there is a threshold level* $\beta_{\text{crit}}^{v,sym1}(\delta)$ *such that broadcaster A gains market shares in the viewer market at the expense of broadcaster B if and only if* $\beta < \beta_{\text{crit}}^{v,sym1}(\delta)$*. Moreover, the threshold level* $\beta_{\text{crit}}^{v,sym1}$ *is increasing in* δ*.*

   Under regime sym2*, broadcaster A gains market shares at the expense of broadcaster B on the whole parameter range.*

   Under regime asym*, for any given* $\delta \in (0,1]$ *there is a threshold level* $\beta_{\text{crit}}^{v,asym}(\delta)$ *such that broadcaster A gains market shares in the viewer market at the expense of broadcaster B if and only if* $\beta > \beta_{\text{crit}}^{v,asym}(\delta)$*. Moreover, the threshold level* $\beta_{\text{crit}}^{v,asym}$ *is increasing in* δ*.*

PROOF: Follows from partially differentiating equilibrium values (equations (10)-(13) for *sym1*, (22)-(24) (Appendix) for *sym2*, and (18)-(20) for *asym*) □

The results of Proposition 2 are summarized in Table 2.

Table 2: Increase in the negative externality

Partial derivative with respect to 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	$\frac{\partial \tau_A}{\partial \beta} > 0$	$\frac{\partial \tau_B}{\partial \beta} > 0$	$\frac{\partial \tau_A}{\partial \beta} > 0$	$\frac{\partial \tau_B}{\partial \beta} > 0$	$\frac{\partial \tau_A}{\partial \beta} > 0$	
Viewer market shares	$\frac{\partial n_A^v}{\partial \beta} \gtreqless 0$	$\frac{\partial n_B^v}{\partial \beta} \gtreqless 0$	$\frac{\partial n_A^v}{\partial \beta} > 0$	$\frac{\partial n_B^v}{\partial \beta} < 0$	$\frac{\partial n_A^v}{\partial \beta} \gtreqless 0$	$\frac{\partial n_B^v}{\partial \beta} \gtreqless 0$
Ad market shares	$\frac{\partial n_A^{ad}}{\partial \beta} > 0$	$\frac{\partial n_B^{ad}}{\partial \beta} < 0$	$\frac{\partial n_A^{ad}}{\partial \beta} \gtreqless 0$	$\frac{\partial n_B^{ad}}{\partial \beta} < 0$	$\frac{\partial n_A^{ad}}{\partial \beta} < 0$	
Profits	$\frac{\partial \Pi_A}{\partial \beta} > 0$	$\frac{\partial \Pi_B}{\partial \beta} > 0$	$\frac{\partial \Pi_A}{\partial \beta} > 0$	$\frac{\partial \Pi_B}{\partial \beta} > 0$	$\frac{\partial \Pi_A}{\partial \beta} > 0$	$\frac{\partial \Pi_B}{\partial \beta} > 0$

Note: This table illustrates the effects of an increase in the size of the negative externality on consumer utility, β. We compare 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.

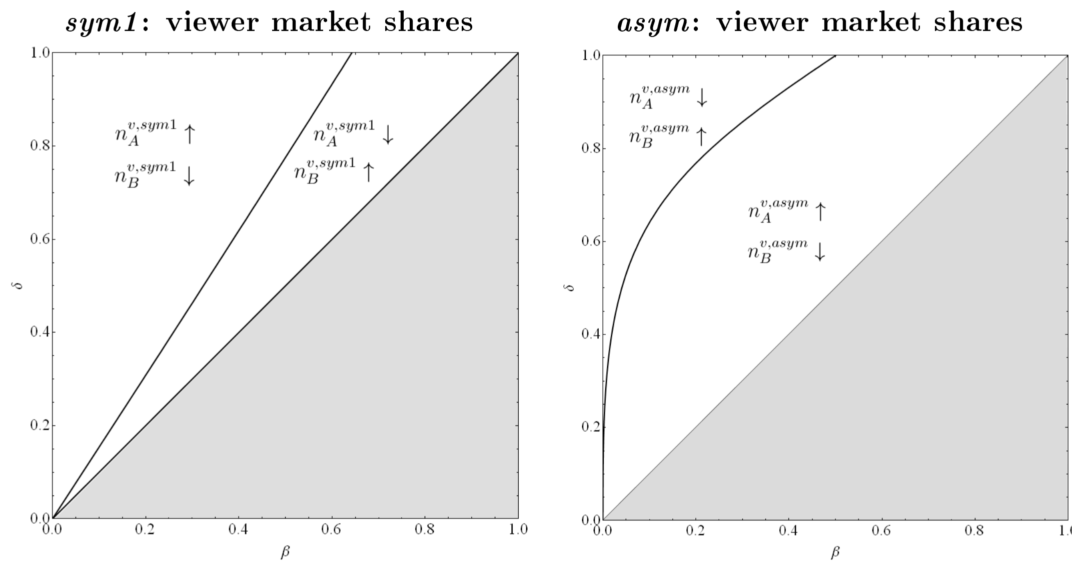
In order to interpret the results, note that an increase in the nuisance cost β alters the decision of viewers which program to watch such that the relative importance of (ad-free) contents is increasing and the relative importance of (moderate) viewer prices is decreasing. Hence, competing for viewers, broadcasters now have stronger incentives to reduce the number of advertisements but weaker incentives to set low viewer prices. Put differently, since by assumption viewers do not abstain from the market, 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 price competition in the viewer market allows for higher viewer prices, too. Due to the relaxed price competition (on both markets), the profits of both broadcasters increase.

If the marginal advertiser is indifferent between advertising on a certain channel and abstaining from the market, 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*.[12] Under regime *sym1* without abstention from the advertising market, however, the identity of the marginal advertiser shifts such that more advertisers opt for the cheaper medium A.

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 is 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. Figure 3 captures the exact movement of viewer market shares in this case. The figure also depicts the ambiguous effect of an increase in the nuisance parameter β on viewer market shares under regime *asym*. As in the symmetric cases, starting from equilibrium and increasing β, the previously marginal viewer ceteris paribus switches to the channel with the smaller number of advertisements, which here is channel B facing the advertising ban. However, this may be outweighed by broadcaster A's reduction in the number of his advertisements. For a given δ, such a reduction attracts the more viewers the higher the nuisance parameter β. Hence, this second effect will be likely to dominate if β is sufficiently large compared to δ.

[12] 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.

Figure 3: AMBIGUOUS EFFECTS OF AN INCREASE IN β



Note: This figure illustrates the effects of an increase in β on viewer market shares in regime *sym1* (left panel), and in regime *asym* (right panel). The area denoting combinations of β and δ for which $n_i^{v,r}$ is increasing (decreasing) in β is indicated by $n_i^{v,r} \uparrow$ ($n_i^{v,r} \downarrow$) with $i \in \{A, B\}$ and $r \in \{sym1, asym\}$.

4.2 Effects of an increase in the positive externality δ

Proposition 3. *As the size of the negative externality δ increases, the equilibrium values evolve as follows:*

1. Prices and profits: *Under all three regimes, both broadcasters set higher prices on the advertising market (where possible). The effects on viewer prices and profits often are ambiguous as depicted in Table .*

2. Advertising market shares: *Under all three regimes, the market shares of both broadcasters increase with one exception: Under regime* sym1*, the market shares of broadcaster A are decreasing.*

3. Viewer market shares: *Under regime* sym1 *(*sym2*), for any given $\delta \in (0,1]$ there is a threshold level $\beta_{\text{crit}}^{v,sym1}(\delta)$ ($\beta_{\text{crit}}^{v,sym2}(\delta)$) such that broadcaster B gains market shares in the viewer market at the expense of broadcaster A if and only if $\beta < \beta_{\text{crit}}^{v,sym1}(\delta)$ ($\beta < \beta_{\text{crit}}^{v,sym2}(\delta)$). Moreover, both threshold levels are increasing in δ.*

Under regime asym*, broadcaster A gains market shares on the viewer market at the expense of broadcaster B on the whole parameter range.*

PROOF: Follows from partially differentiating equilibrium values (equations (10)-(13) for *sym1*, (22)-(24) (Appendix) for *sym2*, and (18)-(20) for *asym*) □

The results of Proposition 3 are summarized in Table 3.

Table 3: INCREASE IN THE POSITIVE EXTERNALITY

Partial derivative with respect to δ

Regime:	Sym1		Sym2		Asym	
Broadcaster:	A	B	A	B	A	B
Viewer prices	$\frac{\partial p_A}{\partial \delta} < 0$	$\frac{\partial p_B}{\partial \delta} < 0$	$\frac{\partial p_A}{\partial \delta} \gtreqless 0$	$\frac{\partial p_B}{\partial \delta} < 0$	$\frac{\partial p_A}{\partial \delta} < 0$	$\frac{\partial p_B}{\partial \delta} \gtreqless 0$
Ad prices	$\frac{\partial \tau_A}{\partial \delta} > 0$	$\frac{\partial \tau_B}{\partial \delta} > 0$	$\frac{\partial \tau_A}{\partial \delta} > 0$	$\frac{\partial \tau_B}{\partial \delta} > 0$	$\frac{\partial \tau_A}{\partial \delta} > 0$	
Viewer market shares	$\frac{\partial n_A^v}{\partial \delta} \gtreqless 0$	$\frac{\partial n_B^v}{\partial \delta} \gtreqless 0$	$\frac{\partial n_A^v}{\partial \delta} \gtreqless 0$	$\frac{\partial n_B^v}{\partial \delta} \gtreqless 0$	$\frac{\partial n_A^v}{\partial \delta} > 0$	$\frac{\partial n_B^v}{\partial \delta} < 0$
Ad market shares	$\frac{\partial n_A^{ad}}{\partial \delta} < 0$	$\frac{\partial n_B^{ad}}{\partial \delta} > 0$	$\frac{\partial n_A^{ad}}{\partial \delta} > 0$	$\frac{\partial n_B^{ad}}{\partial \delta} > 0$	$\frac{\partial n_A^{ad}}{\partial \delta} > 0$	
Profits	$\frac{\partial \Pi_A}{\partial \delta} < 0$	$\frac{\partial \Pi_B}{\partial \delta} \gtreqless 0$	$\frac{\partial \Pi_A}{\partial \delta} \gtreqless 0$	$\frac{\partial \Pi_B}{\partial \delta} \gtreqless 0$	$\frac{\partial \Pi_A}{\partial \delta} > 0$	$\frac{\partial \Pi_B}{\partial \delta} \gtreqless 0$

Note: This table illustrates the effects of an increase in the size of the size of positive externality the number of viewers exerts on advertisers‘ profits, δ. We compare 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.

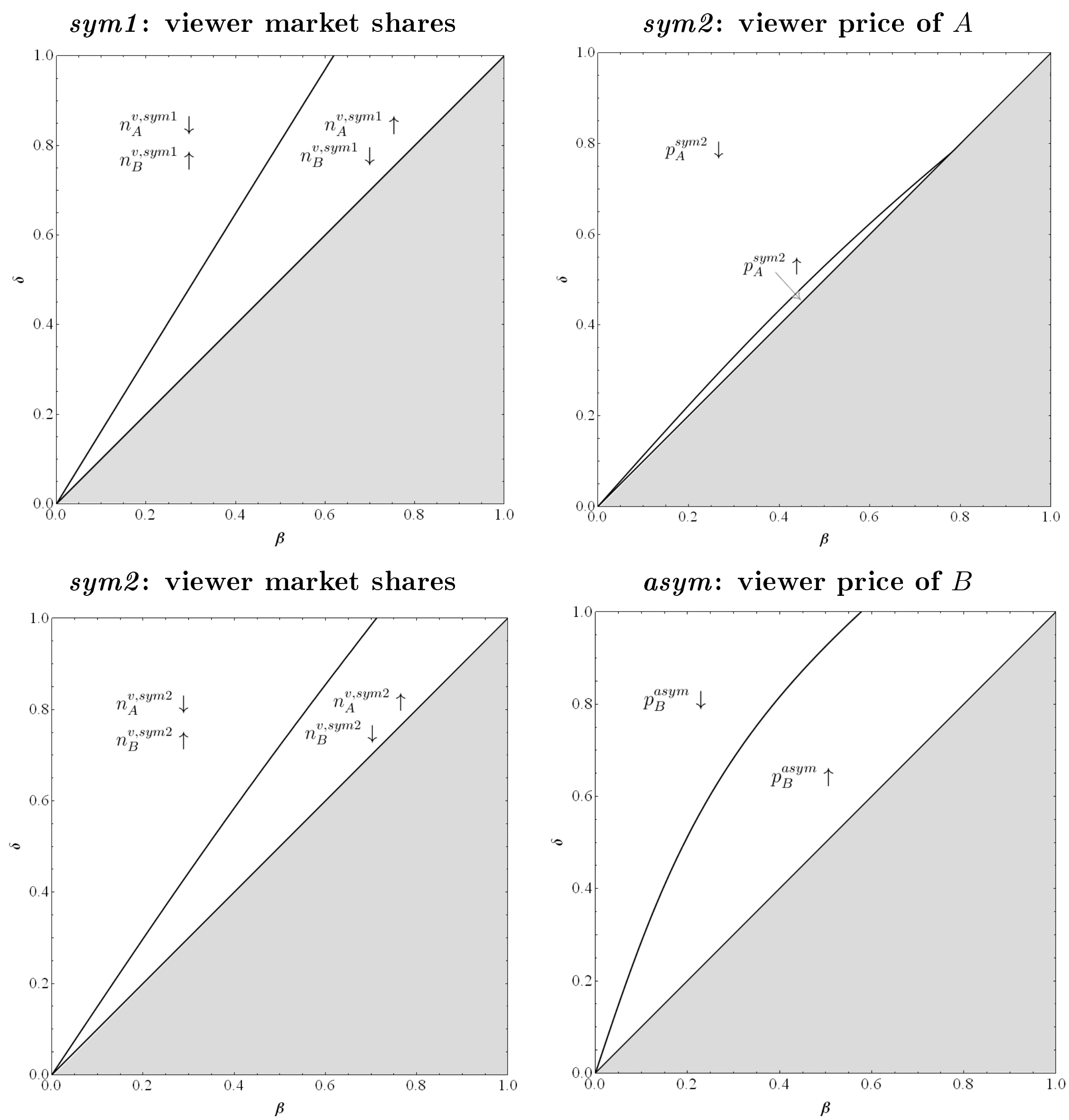
In order to interpret the results, note that an increase in the intensity of the positive externality δ alters the decision of firms in which channel to place an advertisement such that the relative importance of the number of viewers is increasing whereas the relative importance of (moderate) ad prices is decreasing. 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, price competition weakens in the advertising market but intensifies in the viewer market. Hence the overall effect on profits often is ambiguous.

On the one hand, relaxed price competition in the market for advertisements leads to higher advertisement prices. On the other hand, broadcasters tend to decrease their viewer prices in order to increase viewer market shares.

At the same time, starting from equilibrium and increasing δ, under regime *sym1* the previous marginal advertiser will now, ceteris paribus, switch to the channel with the larger number of viewers. As we have seen in Table 1, this is broadcaster B. Hence, channel B gains shares in the ad market at the expense of channel A. Under regimes *sym2* and *asym*, the previous marginal advertisers will now find it profitable to advertise. Hence, all respective advertising market shares increase. These increases in the number of advertisements tend to reduce the number of viewers.

Under regime *sym1* with both viewer prices decreasing, the number of advertisements is becoming relatively more important for consumers' decision which channel to watch. The previous marginal viewer will now switch to the channel with the lower number of advertisements. However, as known from Table 1, the channel with the smaller number of advertisements is broadcaster A if and only if β is sufficiently small compared to δ. The exact relationship is depicted in Figure 4. The figure also shows that the effects of an increase in δ on the viewer market shares under regime *sym2* are similar.

Figure 4: Ambiguous effects of an increase in δ



Note: This figure illustrates the effects of an increase in δ on viewer market shares in regime *sym1* (upper left panel) and in regime sym2 (lower left panel) as well as the effects on viewer prices of A in regime *sym2* (upper right panel), and on viewer prices of B in regime *asym* (lower left panel). The area denoting combinations of β and δ for which x is increasing (decreasing) in β is indicated by $x \uparrow$ ($x \downarrow$) with $x \in \{n_i^{v,r}, p_i^r\}$, $i \in \{A, B\}$ and $r \in \{sym1, sym2, asym\}$.

Moreover, the figure also illustrates that the viewer price of medium B will increase under regime *asym*, if β is sufficiently large relative to δ. This is due to A being less attractive as the number of advertisement in A increases the costs for viewers who choose A. As B does not carry any advertisements, he can afford to increase his price if nuisance from advertisement is large enough. The effects on viewer demand with asymmetric advertising show that due to A decreasing the viewer price, he can overcompensate for carrying advertisements such that B loses market shares on the viewer market. This leads to A having higher profits whereas the effect on the profits of B are ambiguous.

In order to give an intuition for the ambiguous effects on the broadcasters profits, reconsider regime *sym1*. We observe that the profits of broadcaster A who offers the low quality decrease with an increase in δ. Hence, the negative effect of lowering the prices on the viewer market and the loss of market shares on the advertising market always dominate the increase in the advertising price as well as an eventual gain in market shares on the viewer market. By increasing both the ad price and the ad market share, channel B is able to increase its revenues from the advertising market. However, with viewer prices decreasing and an eventual fall in the respective market share, revenues from viewers may shrink. If and only if the negative externality β is sufficiently small, the gains from advertisements will outweigh the losses on the viewer market.

5 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.[13] The second objective is to make quality broadcasts more attractive to consumers which implies an increase in market shares of the quality medium.

There are three possible ways to restrict advertising: imposing a ban on advertisements in the high quality medium (which is what we analyze here), or on advertisements in the low quality medium[14], or imposing a general advertising ban that applies to both broadcasters. The latter is not very realistic and would result in purely vertical competition for viewers with the standard results.

Technically spoken, in the following we compare the equilibrium values of the regimes

[13]It is, however, not clear whether such a reduction is in fact beneficial for viewers or even welfare improving (see Kind et al., 2009).

[14]Since this case is less realistic, it is not presented here in detail. Nevertheless, it yields some interesting results. If only the high quality medium is allowed to carry advertisements, in our model the advertising market will breakdown, i.e. in equilibrium, there will be no (positive demand for) advertising at all.

sym2 and *asym*.[15]

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

1. *market shares of A (B) on the viewer market are bigger (smaller)*

2. *overall amount of advertising is lower*

in the case of asymmetric advertising compared to the case of symmetric advertising.

PROOF: Follows from comparing the respective equilibrium values (equations (22)-(24) (Appendix) for *sym2*, and (18)-(20) for *asym*). □

The effects of an advertising ban on the remaining equilibrium values are depicted in Table 4.

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	$\Pi_A^{sym2} \gtreqless \Pi_A^{asym}$	$\Pi_B^{sym2} > \Pi_B^{asym}$

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*).

While the result concerning the reduction of the overall amount of advertising is intuitive, at a first glance it may be surprising that medium B loses viewers by reducing its advertising level to zero. However, to get an intuition for this finding, note that the

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

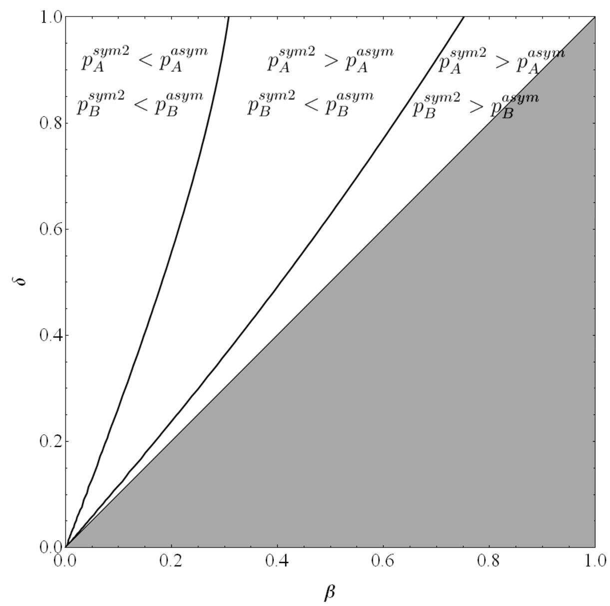
incentives for attracting viewers (by low viewer prices) are twofold on a two-sided media market: First, there is a direct (positive) effect on revenues in the viewer market. Second, there is an indirect (positive) effect on revenues from advertising due to the positive externality viewers excert on 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 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 A in the viewer market are bigger. At the same time, this increase in the number of viewers allows channel A to choose a higher advertising price.

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 has increased, 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 the evolution of viewer prices depends on the relative strength of the externalities between the two markets. As shown in Figure 5, we can distinguish between three cases: If, for any given level of viewer externality δ, the nuisance cost of advertisement β is sufficiently low (high), both channels set a higher (lower) viewer price in the case of asymmetric advertising compared to the case of symmetric advertising; for an intermediate range of β, channel A lowers its viewer price while channel B raises it.

Figure 5: COMPARISON OF BOTH REGIMES (SYM2 VS. ASYM)



Note: This figure illustrates the effects of an advertising ban for broadcaster B on equilibrium viewer prices by comparing the equilibria of the symmetric model with market abstention (regime *sym2*) and the asymmetric model (regime *asym*).

For broadcaster B, being prevented from entering the advertising market obviously is a disadvantage 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. If the nuisance β is high, the effect that the ban intensifies price competition on the viewer market from broadcaster A's perspective dominates.

6 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 analyzed the interplay of the two externalities and their impact on the equilibrium in such a market structure. Moreover, we 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.

Our central 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.

In our analysis, the levels of quality are exogenously fixed at maximum differentiation. Though analytically hardly tractable, the framework at hand also allows for modeling an endogenous decision on quality levels. However, the results with exogenous levels of quality may 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.

Given our results, 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.

7 Appendix

Equilibrium values under regime *sym2*. The derivation of the equilibrium is analogue to regime *sym1*. We define

$$
\begin{aligned}
\Omega_A^{sym2} &\equiv \beta[\delta(12+8\beta\delta-2\beta^2-3\delta^2)-\beta]+4, \\
\Omega_B^{sym2} &\equiv 8-2\beta^2+\beta\delta(26-5\beta^2)-2\delta^2(1-13\beta^3+\beta^4)+\beta\delta^3(8\beta^2-5)-3\beta^2\delta^4, \\
\Delta^{sym2} &\equiv [\beta\delta(\beta^2-6\beta\delta-10)-4][4\beta^4\delta^2+\beta^3\delta(9-16\delta^2)+4(\delta^2-3)] \\
&+ [\beta\delta(\beta^2-6\beta\delta-10)-4][2\beta\delta(5\delta^2-21)+\beta^2(4-46\delta^2+6\delta^4)], \\
\Phi^{sym2} &\equiv 4+\delta[\beta(10+5\beta\delta-3\delta^2)-2\delta], \\
\chi^{sym2} &\equiv 2\delta+\beta[2+\delta(5\delta+4\beta+\delta\beta^2+3\beta\delta^2)], \\
\Lambda^{sym2} &\equiv 16-4\beta^2-16\beta\delta(\beta^2-5)-4\delta^2(1-36\beta^2+5\beta^4) \\
&+ \beta\delta^3(110\beta^2-7\beta^4-16)+3\beta^2\delta^4(10\beta^2-7)-9\beta^3\delta^5 \qquad (21)
\end{aligned}
$$

and obtain the following equilibrium prices:

$$
\begin{aligned}
p_A^{sym2} &= \frac{(1+\beta\delta)^2\Omega_A^{sym2}\Phi}{\Delta^{sym2}}, \qquad & p_B^{sym2} &= \frac{(1+\beta\delta)\Omega_B^{sym2}\Phi}{\Delta^{sym2}}, \\
\tau_A^{sym2} &= \frac{(1+\beta\delta)\Omega_A^{sym2}\chi^{sym2}}{\Delta^{sym2}}, \qquad & \tau_B^{sym2} &= \frac{\Omega_B^{sym2}\chi^{sym2}}{\Delta^{sym2}}. \qquad (22)
\end{aligned}
$$

The corresponding market shares are

$$
\begin{aligned}
n_A^{v,sym2} &= \frac{1}{2}-\frac{(\beta\delta(\beta^2-6\beta\delta-10)-4)^2}{2\Delta^{sym2}}, \\
n_B^{v,sym2} &= \frac{1}{2}+\frac{(\beta\delta(\beta^2-6\beta\delta-10)-4)^2}{2\Delta^{sym2}}, \\
n_A^{ad,sym2} &= \frac{(1+\beta\delta)^2(2\delta-\beta(2+2\beta\delta-3\delta^2))\Omega_A^{sym2}}{\Delta^{sym2}}, \\
n_B^{ad,sym2} &= \frac{(1+\beta\delta)(2\delta-\beta(2+2\beta\delta-3\delta^2))\Omega_B^{sym2}}{\Delta^{sym2}}. \qquad (23)
\end{aligned}
$$

By substituting the above results into the profit function of the broadcasters 1, we obtain

$$
\Pi_A^{sym2} = \frac{(1+\beta\delta)^3(\Omega_A^{sym2})^2\Lambda^{sym2}}{(\Delta^{sym2})^2}, \qquad \Pi_B^{sym2} = \frac{(1+\beta\delta)(\Omega_B^{sym2})^2\Lambda^{sym2}}{(\Delta^{sym2})^2}. \qquad (24)
$$

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