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Advertising on TV: Under- or Overprovision?

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Advertising on TV: Under- or Overprovision?*

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Abstract

We consider a model where TV channels transmit advertising, and viewers dislike such commercials. We find that the less differentiated the TV channels' programs are, the lower is the amount of advertising in equilibrium. Relative to the social optimum, there is underprovision of advertising if TV channels are sufficiently close substitutes. In such a situation, a merger between TV channels may lead to more advertising and thus improve welfare. A publicly owned TV channel can partly correct market distortions, in some cases by having a larger amount of advertising than a private TV channel. It may actually have advertising even in cases where it is wasteful *per se*.

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1 Introduction

The TV industry is important in terms of both the time people spend watching TV and the amount of advertising it transmits.[1] However, the key role played by advertising-financed channels in many countries' TV industries is potentially a mixed blessing. On the one hand, TV commercials may be the most efficient way for firms to advertise their products and can generate a surplus both for individual firms and for society as a whole. On the other hand, viewers dislike being interrupted by commercials.[2] We thus have an ambiguity that raises the question of whether there is over- or underprovision of advertising on TV, as well as the related question of whether there is a need for some kind of public intervention in the sector.

In this paper, we set out to provide answers to these questions with the help of a simple model in which TV stations sell advertising space to advertisers. The basis for the advertisers' willingness to pay for such advertising space is the attention of TV viewers that the stations provide. And in order to get the viewers' attention, the stations offer TV programs. Thus, the TV industry is an example of two-sided markets in which the TV stations offer programs to viewers and advertising space to advertisers, with externalities in both directions.[3]

Obviously, the extent to which viewers dislike advertising on TV is an important factor in determining whether there is too much or too little advertising in equilibrium. In our analysis, we point to another crucial factor which is perhaps less obvious: the degree of competition between TV stations for viewers. If TV stations' program contents are similar, then a viewer's choice of TV station will be mainly driven by the amount of advertising at each station. This makes it hard for TV stations to attract advertisers, since an increase in advertising at one TV station leads to a considerable loss in viewers. In accordance with this, we find, in our formal analysis below, that there is too little advertising on TV when the competition for TV viewers is fierce and too much when it is weak. Thus, even when media firms act as transmitters of advertising, there might be underprovision of commercials. This may come as a surprise, with advertising being a nuisance to viewers. But the driving force for our result is, as explained, the competition between TV channels. Early discussions of the welfare affects of advertising, such as Dixit and Norman (1978) and Becker and Murphy (1993), did not take into account the role of the media firms as transmitters of advertising.[4]

[1] In 1995, the average adult male American spent 17.3 hours watching TV each week (Robinson and Godbey, 1999). In 2002, TV advertising in the US amounted to approximately USD 50 billion, out of a total of approximately USD 115 billion spent on advertising (see *Advertising Age,* http://www.adage.com/images/random/lna03.pdf).

[2] It is documented that viewers try to avoid advertising breaks, see for example Moriarty and Everett (1994) and Danahar (1995). See also Wilbur (2004), who estimates a model of TV competition and finds viewers' disutility to be significant and positive.

[3] To be precise, advertisers incur negative externalities on viewers, while viewers incur positive externalities on advertisers. For general introductions to the theory of two-sided markets, see Armstrong (2004) and Rochet and Tirole (2004).

[4] For a survey of the economics literature on advertising, see Bagwell (2003).

This suggests that, by ignoring the role of media, one might predict overprovision in some cases where there in fact would be underprovision.

A key aspect of our model is that competition leads to higher output, *i.e.*, to a larger number of viewers. In our model, as in many other traditional models for other markets, the total output is lower with monopoly than with perfect competition. On this point, our analysis is at variance with the recent contribution by Anderson and Coate (2005) on the welfare effects of advertising-financed TV. They locate the viewers along a Hotelling (1929) line, varying according to their preferences for TV-program content, and allow the TV channels to choose between the extreme positions on that line.[5] This way, they are able to introduce a minimum of endogenous product differentiation. But this comes at the cost of fixing total TV viewing. We choose a different angle and fix the product differentiation. In so doing, we are able to discuss how program diversity and advertising disutility interplay so that increased advertising at one TV channel makes viewers not only spend more time on the other TV channel but also spend less time on watching TV all together.

As for public intervention, it is noteworthy that different countries have chosen distinctly different public-policy measures towards the TV industry. For instance, some countries have publicly owned TV channels and restrictions on the amount of advertising on TV, while other countries do not intervene in the market at all.[6] The potential for underprovision of advertising suggests that restrictions on the amount of advertising can be misguided. In particular, this is likely to be true if the TV channels are close substitutes.

In many European countries, there are mixed oligopolies in the TV industry with both publicly and privately owned TV channels.[7] The government can partly correct for the distortions in the market for advertising by having a public TV channel compete with a privately owned TV channel. We show that, for sufficiently differentiated TV channels, the public TV channel sells less advertising space than the private channel, thereby partly correcting for the overprovision of advertisements in a system with only privately owned TV channels. Conversely, the public TV channel advertises more than the private one if the TV channels are sufficiently close substitutes. In fact, we find that a welfare maximizing public TV channel advertises even in some cases where advertising is *per se* wasteful (*i.e.*, where the disutility of viewers exceeds the surplus

[5] See also the related work by Gabszewicz, *et al.* (2004). They discuss the equilibrium outcome only and have no comparison with the social optimum, but allow TV channels to pick program content anywhere on the product spectrum. Other contributions in the recent literature on the economic analysis of media industries include Nilssen and Sørgard (2003), Gal-Or and Dukes (2003), and Dukes (2004). The seminal work is Steiner (1952); for a review of the early literature, see Owen and Wildman (1992).

[6] The EU restricts TV advertising to 9 minutes on average, with a maximum of 12 minutes in any given hour, while some of the member states have stricter limits. See details in Anderson (2004) and Motta and Polo (1997). In the US, the National Association of Broadcasters once set an upper limit. In 1981, this was found to violate antitrust laws (see Owen and Wildman, 1992, ch. 5, and Hull, 1990). No restrictions (except for advertising on children's programs) exist in the US today.

[7] See Motta and Polo (1997) for a survey of the media industry in Europe.

that the advertising generates for the producers).

This article is organized as follows. The formal model is presented in the next section, and in Section 3 we derive the equilibrium outcomes. In Section 4 we find social optimum, and in Section 5 we compare market equilibrium and social optimum. In Section 6 we analyze the consequences of having a welfare maximizing TV channel that is owned by the public sector, and we offer some concluding remarks in Section 7.

2 The model

There are two TV stations, channel 1 and channel 2, and a continuum, of measure one, of identical viewers. Denote by V_i the time that each viewer spends watching TV programs on channel $i = 1, 2$, and let the utility function be given by[8]

$$U = V_1 + V_2 - \frac{1}{1+b}\left(\frac{V_1^2}{2} + \frac{V_2^2}{2} + bV_1V_2\right). \tag{1}$$

The parameter $b \in [0, 1)$ is a measure of product differentiation: The higher is b, the closer substitutes are the two TV channels from the viewers' point of view. As will be clear below, our formulation ensures that the parameter b only captures product differentiation and has no effect on market size. Note that we may interpret V_i both as the time that each viewer spends watching channel i and as the number of viewers, since we have normalized the population size to 1.

We consider TV channels that are financed by advertising and that viewers can watch free of charge. However, viewers have a disutility of being interrupted by commercials. To capture this, we assume that the viewers' subjective cost of watching channel i is $C_i = \gamma A_i V_i$, where A_i is the level of advertising per time unit and $\gamma > 0$ is a parameter that measures the viewers' disutility of being interrupted by commercials. A viewer's consumer surplus is thus given by

$$CS = U - \gamma(A_1V_1 + A_2V_2).$$

Setting $\frac{\partial CS}{\partial V_i} = 0$, we find that optimal viewer behavior implies

$$V_i = 1 - \gamma\frac{A_i - bA_j}{1-b}. \tag{2}$$

Defining $V \equiv V_1 + V_2$ and $A \equiv A_1 + A_2$, we see from equation (2) that

$$V = 2 - \gamma A. \tag{3}$$

The total time viewers spend on the two TV channels is thus strictly decreasing in

[8] This function is a version of a standard quadratic utility function as exposed, *e.g.*, by Vives (1999). Our specification is the same as the one we used in Barros, *et al.* (2004) and Kind, *et al.* (2005).

the aggregate advertising level and the viewers' marginal disutility of commercials. Equation (3) further makes it clear that the size of the market - measured in terms of TV viewers or time spent watching TV programs - is independent of b for any given level of total advertising A.

TV channel i charges the price R_i per advertising slot it sells. The direct cost of inserting an advertising slot is set equal to zero, so that the profit level of channel i is

$$\Pi_i = R_i A_i. \tag{4}$$

Let A_{ik} denote advertiser k's advertising level on channel i. The advertiser's gross gain from advertising at channel i is naturally increasing in its advertising level and in the number of viewers exposed to its advertising. We make it simple by assuming that the gross gain equals $A_{ik}V_i$. This implies that the net gain for advertiser k from advertising on TV equals

$$\pi_k = (A_{1k}V_1 + A_{2k}V_2) - (A_{1k}R_1 + A_{2k}R_2). \tag{5}$$

With a slight abuse of terminology, we label π_k the profit of producer k. There are n identical producers, and we let $\pi_A \equiv \sum_{k=1}^{n} \pi_k$ denote aggregate profit for these firms.

We consider the following two-stage game:

Stage 1: TV channels set advertising levels.

Stage 2: The advertisers choose amounts of advertising to buy.

One noteworthy feature of our set-up is that the TV channels are quantity setters in advertising.[9] If program choice on TV is inflexible in the short run - with a given amount of time between each program - such an assumption is plausible. However, there might be arguments indicating that TV channels are more flexible concerning the amount of advertising.[10] If so, price setting on advertising is a more natural choice. It can be shown that our main results still hold if we assume price rather than quantity setting among TV channels.[11]

Unless otherwise stated, we assume that the TV channels act non-cooperatively.

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[9] Our set-up is analogous to models of successive oligopoly, such as Salinger (1988), where producers and retailers set quantities sequentially.

[10] When transmitting newscasts or sport events the TV channel is quite flexible in its choice of the amount of advertising. Moreover, to accommodate a small amount of advertising a TV channel can fill in with advertising for its own programs ('tune-ins'). For details concerning tune-ins, see Schachar and Anand (1998).

[11] Barros *et al.* (2004) formulate a model where media firms set prices of advertising rather than quantities. The equilibrium outcomes they find are analogous to the ones we report here. For a more detailed discussion of price versus quantity competition in the market for TV advertising, see Nilssen and Sørgard (2003).

3 Equilibrium outcomes

We solve the game by backward induction. At stage 2, the advertisers simultaneously determine how much to advertise on the two channels, taking advertising prices as given. Solving $\partial\pi_k/\partial A_{1k} = \partial\pi_k/\partial A_{2k} = 0$ simultaneously for the k producers, and then using that $A_i = \sum_{k=1}^{n} A_{ik}$, we find that demand for advertising equals

$$A_i = \frac{1}{\gamma}\left(\frac{n}{n+1}\right)\left[1 - \frac{R_i + R_j b}{1+b}\right], \qquad i,j = 1,2, \quad i \neq j. \tag{6}$$

As expected, we thus have a downward-sloping demand curve for advertising ($\frac{dA_i}{dR_i} < 0$). More interestingly, we see that demand for advertising on each channel is decreasing also in the other channel's advertising price ($\frac{dA_i}{dR_j} < 0$). This follows from advertising on the two channels being complementary goods when viewers dislike advertising. To see why, suppose that R_j increases, so that the advertising level on channel j falls. Thereby, that channel becomes more attractive for the viewers, while channel i becomes relatively less attractive. The latter in turn means that channel i will have a smaller audience, which translates into a lower demand for advertising.

Using (6), we can write the inverse aggregate demand curve for advertising on channel i as

$$R_i = 1 - \gamma\left(\frac{n+1}{n}\right)\left(\frac{A_i - A_j b}{1-b}\right). \tag{7}$$

Note that

$$\frac{dR_i}{db} = -\gamma\,(n+1)\,\frac{A_i - A_j}{n\,(1-b)^2}.$$

This means that the willingness to pay for advertising on channel i is increasing in b if and only if the advertising level on that channel is lower than on the other channel ($A_i < A_j$). This reflects the observation that, the less differentiated the TV programs are, the more prone are viewers to shift from a channel with much advertising to a channel with little advertising.

The TV channels set their advertising levels non-cooperatively at stage 1. (For collusion, see below.) Solving $\frac{d\Pi_i}{dA_i} = 0$, $i = 1,2$, subject to (7), we find that the equilibrium advertising level at each TV channel equals:

$$A_i^M = \frac{1}{\gamma}\left(\frac{n}{n+1}\right)\left(\frac{1-b}{2-b}\right), \tag{8}$$

where the superscript M denotes market equilibrium. The advertising level is thus decreasing in the viewer disutility of advertising (γ), which is quite natural.[12] We further see that

$$\frac{dA_i^M}{db} = -\frac{1}{\gamma}\left(\frac{n}{n+1}\right)\left(\frac{1}{2-b}\right)^2 < 0,$$

[12] See also Anderson and Coate (2005).

which means that the equilibrium advertising level is lower the less differentiated the TV channels are. To understand this result, note that a TV channel attracts viewers by having a limited amount of advertising. The better substitutes the viewers perceive the two TV channels to be, the more sensitive they are to differences in levels of advertising. A high b thus gives each TV channel an incentive to set a relatively low advertising level in order to capture viewers from the other channel.

Note also that

$$\frac{\partial A_i^M}{\partial n} = \frac{1-b}{(n+1)^2 \gamma (2-b)} > 0. \tag{9}$$

An increase in the number of advertisers thus increases the demand for advertising. It is then optimal for the TV channels to offer more advertising space. We have:

Proposition 1 *Non-cooperative equilibrium levels of advertising on TV are smaller (i) the less differentiated the TV channels' programs are perceived to be; (ii) the higher the viewers' disutility of advertising; and (iii) the lower the number of advertisers.*

Inserting for A_i^M in (8) into the expressions for profit in (4) and (5), we find the equilibrium profit levels of TV stations and advertisers:

$$\Pi_i^M = \frac{1}{\gamma}\left(\frac{n}{n+1}\right)\frac{1-b}{(2-b)^2}, \text{ and } \pi_k^M = \frac{1}{\gamma}\frac{2}{(n+1)^2}\frac{(1-b)^2}{(2-b)^2}, \; i=1,2, \; k=1,...,n. \tag{10}$$

We see that profits are decreasing in both γ and b. Higher disutility for consumers from watching advertising leads to less advertising, which is disadvantageous for both the TV channels and the advertisers. A higher b will, as explained above, lead to less advertising, and again, both TV channels and advertisers are worse off. It can further be verified from (10) that an increase in the number of advertisers leads to higher profits for the TV channels, but lower profits for the advertisers. This is because the market power of the advertisers relative to the TV channels falls, so that the advertising price increases for any given advertising level. We summarize our results concerning profits:

Proposition 2 *The non-cooperative equilibrium profit levels for the TV channels as well as the advertisers are higher (i) the more differentiated the TV channels' programs are, and (ii) the lower the viewers' disutility of advertising is. The larger is the number of advertisers, the higher is the profit level of the TV channels and the lower the profit level of the advertisers.*

Finally, let us consider collusion between the TV channels. If $b = 0$, the TV channels products are by definition independent, and collusion has no effect at all. At the other extreme, we know that the TV channels compete away (almost) all advertising and have close to zero profits when b approaches 1. This is a prisoners' dilemma situation, where the firms would have been jointly better off with more advertising on both channels. This suggests that collusion between the TV channels leads to more advertising than in the non-cooperative equilibrium for all $b \in (0, 1)$, and more so the less differentiated the TV programs are. Formally, we can derive the first-order conditions for a collusive outcome from the TV channels' joint profit maximization problem. We then find that the equilibrium advertising level for channel i equals:

$$A_i^C = \frac{1}{2\gamma}\frac{n}{n+1} \tag{11}$$

where the superscript C denotes collusion. Note that differentiation as such does not play any role if the TV channels collude. The reason for this is that a reduction in differentiation has no competitive effect in a collusive outcome, and therefore does not trigger any change in the chosen level of advertising.

By substituting A_i^C into the expressions for profit in (4) and (5), we find that profits for the TV channels and the advertisers, respectively, are:

$$\Pi_i^C = \frac{1}{4\gamma}\frac{n}{n+1}, \text{ and } \pi_k^C = \frac{1}{2\gamma}\frac{1}{(n+1)^2}.$$

The following can now be established:

Proposition 3 *For any $b \in (0,1)$, advertising levels and profits are higher when the TV channels collude than when they act non-cooperatively, and are independent of the degree of product differentiation between the TV channels' programs. Advertising levels and profits respond to changes in viewer disutility of advertising and the number of advertisers qualitatively in the same way as when TV channels act non-cooperatively.*

Proposition (3) suggests that any anti-competitive measure between TV channels increases the amount of advertising. An anti-competitive merger, for instance, will trigger more advertising. Below, we will show that this has some interesting welfare implications.

4 Social optimum

We express welfare as

$$W = CS + \Pi_1 + \Pi_2 + \pi_A. \tag{12}$$

With a total of $A_1 + A_2$ advertising slots on the two TV channels, the advertisers have an aggregate gain from advertising on TV equal to $A_1V_1 + A_1V_2$. The money-equivalent consumer disutility from this advertising equals $\gamma(A_1V_1 + A_1V_2)$. Since a main purpose of this paper is to show that the market may underprovide advertising, we assume that no additional consumer surplus is generated by the sales of products triggered by this advertising.[13] Thereby we have "minimized" the social gains from

[13] Suppose, for instance, that all consumers have the same willingness to pay for each unit of the goods. The producers will then charge the consumers a price equal to their reservation price. See also Anderson and Coate (2005).

advertising. Accordingly, we can express welfare as

$$W = U + (1 - \gamma)(A_1 V_1 + A_2 V_2).$$

From the welfare function, we immediately see that it is socially beneficial with advertising on TV if and only if $\gamma < 1$. In contrast, there will be advertising in market equilibrium even when $\gamma \geq 1$. Formally, by solving $\frac{dW}{dA_i} = 0$, $i = 1, 2$, we find that the socially optimum advertising level equals

$$A_i^* = \begin{cases} \frac{1-\gamma}{\gamma(2-\gamma)}, & \text{if } 0 < \gamma < 1 \\ 0, & \text{if } \gamma \geq 1 \end{cases} \tag{13}$$

Note that the socially optimum amount of advertising is independent of how close substitutes the TV channels' programs are (*i.e.*, it is independent of b). This is natural, since commercials are equally disturbing for the consumers regardless of the extent of horizontal differentiation between the TV channels. The optimal level of advertising is thus only a function of γ, the viewers' disutility parameter. Differentiation of (13) further shows the intuitively obvious result that A_i^* is decreasing in the consumers' disutility of advertising for all $\gamma \in (0, 1)$.

Inserting for A_i^* we find that welfare in social optimum equals

$$W^* = \begin{cases} \frac{1}{\gamma(2-\gamma)}, & \text{if } 0 < \gamma < 1 \\ 1, & \text{if } \gamma \geq 1. \end{cases} \tag{14}$$

From (14) we see that $\frac{dW^*}{d\gamma} < 0$ for $\gamma \in (0, 1)$. The reason for this relationship is two-fold. First, consumer surplus is decreasing in γ. This is a direct effect. Second, there is an indirect effect through the disutility parameter's effect on the advertising level. We know that higher disutility leads to a lower amount of advertising in social optimum ($\frac{dA_i^*}{d\gamma} < 0$ for $\gamma \in (0, 1)$). This results in a reduction in the society's use of value-enhancing TV commercials.

To sum up, we have

Proposition 4 *In social optimum, advertising levels and welfare are decreasing in viewers' disutility from watching advertising, and there is no advertising in optimum if this disutility is sufficiently high ($\gamma \geq 1$). Welfare is independent of the degree of product differentiation and the number of advertisers.*

5 A Comparison

As noted above, the equilibrium outcome depends on whether TV channels compete or collude. Let us therefore first compare the social optimum with the non-collusive equilibrium, and then with the collusive equilibrium.

5.1 Non-collusive equilibrium vs. social optimum

Using equations (12) and (8), we can express welfare in the non-cooperative equilibrium as

$$W^M = \frac{\left[\gamma\left(n+1\right)+\left(1-b\right)\left(\gamma+2n\right)\right]\left(2+n-b\right)}{\gamma\left(2-b\right)^2\left(n+1\right)^2}. \tag{15}$$

Let us start out with the limiting case where $n \to \infty$ (recall that the socially optimal level of advertising is independent of n). Denoting values in this case with a bar (*e.g.*, $\bar{A}^M \equiv \lim_{n=\infty} A^M$), we have

$$\bar{A}^M = \frac{2\left(1-b\right)}{\gamma\left(2-b\right)}, \text{ and } \bar{W}^M = \frac{2\left(1-b\right)+\gamma}{\gamma\left(2-b\right)^2}. \tag{16}$$

Using equations (13) and (16), we find that the difference between advertising levels in social optimum and equilibrium equals

$$\bar{A}^* - \bar{A}^M = -2\frac{\gamma-b}{\gamma\left(2-\gamma\right)\left(2-b\right)}.$$

Thus, there is too much advertising in market equilibrium if and only if $\gamma > b$. The driving force behind this result is the TV stations having high market power over their viewers when the channels' program contents are poor substitutes. The TV channels exploit this market power by selling a larger amount of advertising slots to the advertisers, even though this reduces the viewers' utility from watching TV. However, competition for viewers forces the TV channels to have less advertising, and less so the closer substitutes their programs are. We have shown that independent of viewers' disutility of advertising, the equilibrium advertising level equals zero in the limit as b approaches one. This obviously is below social optimum if $\gamma < 1$. More generally, competition between the TV channels is socially destructive if $b > \gamma$, in which case there is underprovision of advertising in equilibrium.

With a finite number of advertisers, there will be a downward shift in demand for advertising (cf. equation (9)). This means that it is less scope for overprovision of advertising, and the critical value of b will be below γ. By differentiating (15) with respect to b and n, we have that:

$$\frac{dW^M}{db} = -\frac{2n\left(n+\gamma-1\right)\left(b-\hat{b}\right)}{\gamma\left(n+1\right)^2\left(2-b\right)^3}, \text{ and } \frac{dW^M}{dn} = \frac{2\left(1-b\right)\left(n+\gamma-1\right)\left(b-\hat{b}\right)}{\gamma\left(n+1\right)^3\left(2-b\right)^2}, \tag{17}$$

where

$$\hat{b} \equiv \frac{\gamma(n+2)-2}{n+\gamma-1}. \tag{18}$$

There is too much advertising in market equilibrium if $b < \hat{b}$. In this case, an increase in b or a reduction in n result in higher welfare, since less product differentation or a smaller number of advertisers would result in less advertising. Likewise, it would be welfare improving with more product differentiation and a larger number of advertisers if $b > \hat{b}$, since in that case there will be too little advertising from a social point of view. Moreover, it can also be shown that there will be underprovision of advertising in market equilibrium if viewers' disutility from advertising is sufficiently low.[14]

The relationship between advertising in the non-cooperative equilibrium and in social optimum is illustrated in the left-hand side panel of Figure 1. The curve labelled $A^M_{n=4}$ corresponds to the case of $n = 4$ advertisers, while the curve labelled $\bar{A}^M$ considers the limit value as $n \to \infty$.[15] For all $b < 1$, the latter curve has the higher values. This is because the equilibrium level of advertising is increasing in n, while the social optimum is independent of n. The right-hand side panel of Figure 1 shows the corresponding relationship between channel differentiation and welfare. Note in particular the inefficiency of the market economy for high values of b.

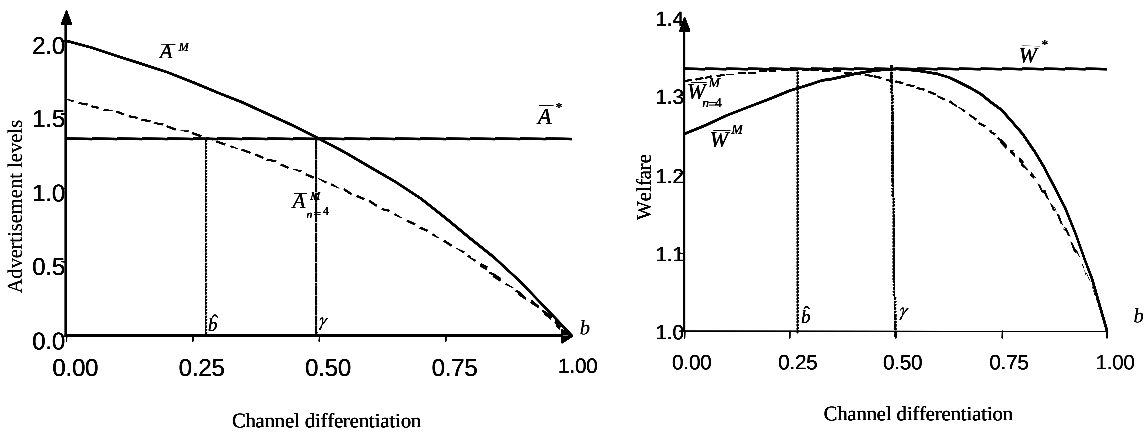

Figure 1: *Comparision between social optimum and market equilibrium.*

We can summarize our results as follows:

Proposition 5 *In an equilibrium where the TV channels act non-cooperatively, there is too much advertising if* $b < \frac{\gamma(n+2)-2}{n+\gamma-1} \equiv \hat{b}$ *and too little advertising if* $b > \frac{\gamma(n+2)-2}{n+\gamma-1} \equiv \hat{b}$.

5.2 Collusive equilibrium vs. social optimum

Finally, let us compare the collusive outcome with the social optimum. When the TV channels collude, they are able to counter the effect of product differentiation. Therefore, advertising levels will be independent of b. This is true also for social optimum, and by comparing (11) and (13) we find:

[14] By rearranging (18) we find that there will be underprovision of advertising if $\gamma < \gamma^L \equiv \frac{\hat{b}(n-1)+2}{n+2-\hat{b}}$.

[15] The curves are given by equations (8) and (16), respectively.

Proposition 6 *In an equilibrium in which the TV channels collude, there is too much advertising if* $\gamma > \frac{2}{n+2}$ *and too little advertising if* $\gamma < \frac{2}{n+2}$.

We know that a shift from competition to collusion leads to more advertising. However, Proposition 6 shows that there can be underprovision of advertising even with collusion. The reason for this is that, for any finite number of n, the advertisers will have some market power over the TV channels ('monopsony power'). All else equal, this means that demand for advertising is too small from a social point of view. Only in the limit as $n \to \infty$ will it be true that collusion between the TV channels necessarily generates too much advertising.

Collusion between the TV channels will have positive welfare effects to the extent that it brings us closer to the socially optimal level of advertising. Note that there is a formal resemblance between collusion and a merger in our model. Thus, our results also point to the possible existence of welfare-improving mergers in the TV industry, not because of any cost efficiency, but because viewers' disutility from advertising creates negative externalities between the TV channels that may result in too little advertising. A merger internalizes these externalities and may therefore improve on welfare compared to a no-merger situation.[16]

6 Public Policy: Mixed duopoly

The analysis above suggests that the level of advertising in market equilibrium may be too high from a social point of view, particularly if the TV channels are poor substitutes. In this case a public regulation that puts an upper limit on the amount of advertising may be a welfare enhancing policy. Such a policy has been implemented in many countries.[17] Obviously, binding restrictions on the amount of advertising are detrimental to welfare if the market provides too few commercials. However, in such a case, other measures might help. One possibility could be to welcome mergers, as indicated above.

Regulation of advertising levels on private TV channels have proven to become increasingly difficult over time. One reason for this is that the regulators are exposed to lobbying pressure. Another reason, which probably is more important (and increases the power of lobbyists), is that technological progress and increased globalization make it increasingly more difficult to enforce an efficient regulation policy towards private TV channels.[18] It is natural to ask, therefore, how the government can affect the equilibrium outcome through ownership of one of the TV stations.

[16] The insight that a monopoly may perform better than more competitive market structures if there are externalities, goes back at least to Buchanan (1969).

[17] See Motta and Polo (1997) and Anderson (2004).

[18] One example of this comes from Norway, where there are restrictions on allowed advertising levels. Even though these restrictions have become less severe over time, the private station TV3, owned by Modern Times Group AB, has chosen to broadcast from the UK to the Norwegian market in order to avoid the Norwegian restrictions on advertising levels. Thus, it is not an empty threat when TV

The presence of one public and one major private TV channel (mixed duopoly) is common in many European countries.[19] While public TV channels historically have not been financed by advertising, this has gradually changed over time (*e.g.*, by allowing firms to sponsor programs). The main reason for the change is the fact that for instance expensive sport events have made it politically more difficult to finance public TV channels through licenses. However, we will not consider this financial aspect. Instead, we consider a situation where the government owns channel 1 (*TV1*), which maximizes welfare (W) with respect to its own level of advertising. The advertising level on the other channel (*TV2*) is assumed to be unregulated.

The TV channels simultaneously set advertising levels at stage 1 and the producers decide how many advertising slots to buy at stage 2. Now the advertising level at channel 1 is set according to $A_1 = \arg\max W$, while $A_2 = \arg\max \Pi_2$. We consider only the non-cooperative outcome.

Independently of who owns the TV channels, the outcome of stage 2 is given by equation (7). Provided that both TV channels have positive advertising levels (see below), we find that stage 1 yields the following advertising levels:

$$A_1^P = \frac{(1-b)\left[2(1-\gamma)+(2b-\gamma b+2-2\gamma)\,n\right]}{(2-\gamma)\,\gamma\,(2-b^2)\,(n+1)}, \text{ and} \tag{19}$$

$$A_2^P = \frac{(1-b)\left[b\,(1-\gamma)+(b-\gamma b+2-\gamma)\,n\right]}{(2-\gamma)\,\gamma\,(2-b^2)\,(n+1)}. \tag{20}$$

We see that the potential problem of no advertising at all as b approaches 1 remains unsolved even with a government-owned TV channel. The reason is that, since the TV channels are almost perfect substitutes in this case, imposing advertising on the public channel would make all viewers watch the private channel.

Above, we found that there is too little advertising in the market equilibrium if $b > \hat{b}$. Consistent with this, we have

$$A_1^P - A_2^P = \frac{(1-b)\,(n+\gamma-1)}{\gamma\,(n+1)\,(2-b^2)\,(2-\gamma)}\left(b-\hat{b}\right).$$

This means that the publicly owned TV channel will advertise more than the private, profit-maximizing TV channel if $b > \hat{b}$. This is quite natural, since it, by so doing, partly corrects for the underprovision of advertising which would have been the case if both channels had been private, profit-maximizing entities.

stations argue that they will serve the market from abroad if there is a strict regulation of advertising levels.

[19] There are several studies of mixed duopoly, see for example De Fraja and Delbono (1989) and Cremer *et al.* (1991). Nilssen and Sørgard (2002) present, as far as we know, the only mixed-oligopoly study relating to the media industry. However, their study is a Hotelling model with a directional constraint, not capturing the consumers' disutility from advertising. In a related study, Nilssen (2000) discusses mixed oligopoly in a payments market where, like in the present media context, there are negative externalities among firms in addition to the traditional oligopoly externality.

Figure 2 illustrates the difference between the advertising levels when $\gamma = 1/2$ for the limit case $n \to \infty$ (where $\hat{b} = \gamma$). In the neighborhood of $b = \gamma = 1/2$, we see that the public channel advertises increasingly more than the private channel the closer substitutes the TV stations are. However, since the Bertrand-paradox-style result that there will be no advertising in the limit as the channels are about to become perfect substitutes is still present, the curve is downward-sloping when b approaches 1.

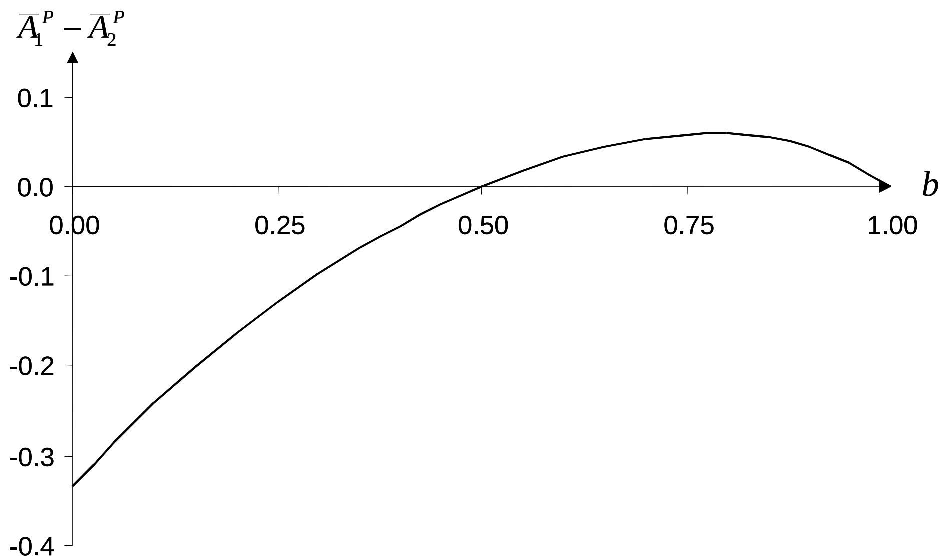

Figure 2: *The difference in advertisement levels between the public and the private channel.*

Suppose that $\gamma > 1$, in which case there will be no advertising in social optimum. Does this mean that a public TV channel in a mixed duopoly should carry no advertising? - No, not necessarily. From equation (19) we find that $A_1 > 0$ if $\gamma < \tilde{\gamma} \equiv 2\frac{1+(1+b)n}{2+(2+b)n}$, where $\tilde{\gamma}$ is strictly increasing in b and n. Since $\tilde{\gamma}$ generally is greater than 1, we see that the government may find it optimum to allow advertising on its own channel even when advertising is wasteful as such. This is because such advertising has an indirect positive effect on the surplus generated by the private TV channel. To see this, consider the limit case when $n \to \infty$. If $\gamma = 1$, then advertising has neither a positive nor a negative social value *per se*. The direct effect of a marginal increase in A_1 is to generate some profit for *TV1* that is exactly matched by a loss in consumer surplus. However, the indirect effect of the increase in A_1 is to make *TV2* relatively more attractive for any given advertising level A_2. Thereby, *TV2* will observe a positive shift in its demand for advertising and thus have a non-marginal increase in profits. The net effect of the higher A_1 is thus to improve welfare due to the higher profit level for *TV2*. From this, it follows that it must be optimum to set A_1 strictly positive when $\gamma = 1$. By continuity, the same must be true also if γ is somewhat larger than 1.[20]

[20] Note that there is no reason to set $A_1 > 0$ if $\gamma \geq 1$ and $b = 0$. The reason for this is that the two

If $\gamma > \tilde{\gamma}$ the publicly owned *TV1* sets $A_1^P = 0$. Inserting for this, we can then use equation (4) and (7) to find that profit maximizing behavior by *TV2* implies

$$A_2^P = \frac{1}{\gamma}\left(\frac{n}{n+1}\right)\left(\frac{1-b}{2}\right). \tag{21}$$

In this case there is obviously too much advertising from a social point of view. From equation (21), we further see that the advertising level is decreasing in b and increasing in n, as is the case in the market equilibrium where both TV stations are profit maximizing firms.

We can summarize our results as follows:

Proposition 7 *In a mixed duopoly, the public TV channel has the higher advertising level if and only if $b > \hat{b}$. Moreover, the public TV channel may carry advertising even when advertising is socially wasteful, which happens for $1 < \gamma < \tilde{\gamma}$.*

Proposition 7 is illustrated graphically in Figure 3 for $\gamma = 1.1$ and $n \to \infty$.

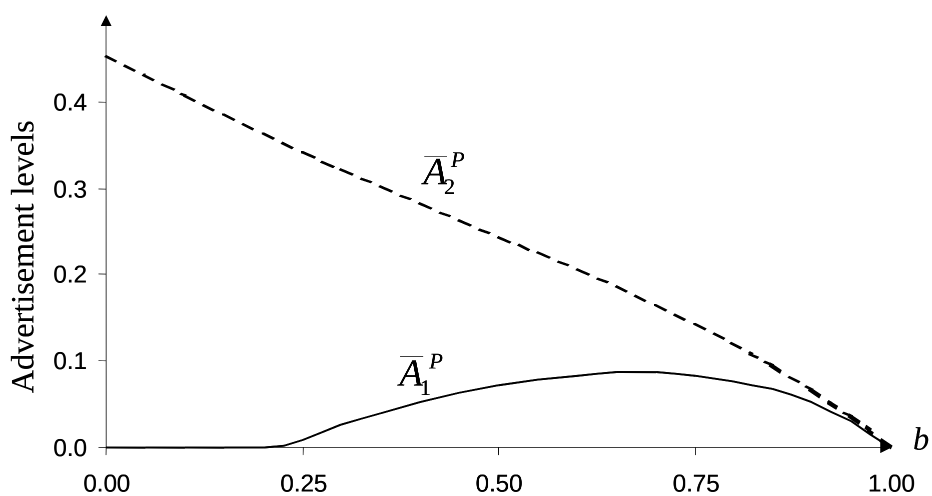

Figure 3: *Advertisement levels when advertising is intrinsically wasteful.*

7 Concluding remarks

In contrast to most of the existing literature, we have modeled the media firm as an intermediate player that transmits advertising to consumers. It turns out that such a modeling approach is decisive for the answer to the question of whether there is over- or underprovision of advertising.

TV channels' programs now are completely independent, so that the advertising level on *TV1* does not have any indirect effect on the profit level of *TV2*.

Our starting point is that advertising-financed TV is a mixed blessing. Advertising is good for the sales of products because it generates a surplus, and bad for viewers because they typically dislike being interrupted by commercials on TV. However, our main point is that underprovision of advertising may happen, and is more likely the less differentiated the TV channels' programs are. In such situations, restrictions on the amount of advertising can be detrimental to welfare. In fact, it may actually be welfare enhancing to allow an anti-competitive merger between TV channels.

We also point to the fact that the nature of competition as such might be crucial for whether there is over- or underprovision of advertising on TV. If there is collusion on advertising, then the differentiation between TV channels' programs plays no role for the amount of advertising that is provided. Collusion on advertising means that they succeed in having a rather large amount of advertising on TV. Since advertising is observable and deviation therefore easy to detect, there might be scope for such a collusive behaviour. If one observes TV channels advertising a lot even in a situation where their programs appear to be rather close substitutes, this is an indication that there is collusion on advertising. An alternative to imposing restrictions on advertising might then be to let the competition authorities scrutinize the TV channels. Note that the TV channels can compete along some dimensions, such as for example programming investments, and despite that collude on advertising. This implies that it is not enough to study whether the TV channels compete or not, but one must rather look in detail into the nature of competition on advertising as such.

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