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Media market concentration, advertising levels, and ad prices ☆

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ABSTRACT

Standard media economics models imply that increased platform competition decreases ad levels and that mergers reduce per-viewer ad prices. The empirical evidence, however, is mixed. We attribute the theoretical predictions to the combined assumptions that there is no advertising congestion and that viewers single-home. Allowing for crowding in viewer attention spans for ads may reverse standard results, as does allowing viewers to multi-home.

1. Introduction

When Fox television entered the US market, advertising levels on NBC, CBS, and ABC rose from 7 minutes per hour in 1989 to around 9 minutes in 1998.[2] This suggests that entry may induce higher ad levels. However, standard models of advertising-financed media platforms, such as Anderson and Coate (2005), predict that entry should lower ad levels (and raise per-viewer ad prices). They also predict that mergers should have the opposite effect, of raising ad levels and lowering ad prices.[3] Some support for this standard prediction is provided by the radio industry executive cited in Anderson and Coate (2005), who argued that ad levels rise after a merger.

Some empirical studies indicate predictions opposite from the standard theory. Focusing on local radio markets, Brown and Williams (2002) find that local ownership concentration slightly increases ad prices. Brown and Alexander (2005) report a similar result in the TV market (interestingly, they find that the ad volume might increase as well). Jeziorski (2011) finds that ad levels fall with concentration.

Most studies indicate mixed evidence or no clear-cut result in one or the other direction. Chipty (2006) finds no systematic relationship between ownership structure and ad prices (or ad levels). Sweeting (2010) investigates advertising levels using a panel of data from music stations based on airplay data from 1998 to 2001. He does not find clear evidence of a relationship between ownership of several stations and the advertising level. In a structural analysis of two-sided radio markets, Tyler Mooney (2011) finds that ad prices and ad volume may increase or decrease with concentration.[4]

Standard theory models assume that viewers single-home and that there is no advertising congestion. The former means that each

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1 Author is also affiliated with CEPR, CESifo, ENCORE, and ZEW.

2 See TV Dimensions 2000 (18th Ed), Media Dimensions, Inc.

3 Gal-Or and Dukes (2006) analyze the profitability of media mergers in a somewhat different setting. They postulate that advertisers compete in the market place and that advertisers and media platforms engage in bilateral bargaining over the advertising price. Advertising is informative as in Grossman and Shapiro (1984) and, thus, imposes a negative externality on the competitor in the market place. Gal-Or and Dukes (2006) find that "small" mergers may be profitable when "large" mergers are not. The driving force for their results is that a media merger affects the bargaining position of the media platform vis-a-vis the advertiser. They confirm the standard result that a merger leads to higher advertising levels.

4 Chandra and Collard-Wexler (2009) find that mergers of Canadian newspapers did not change ad prices. This is consistent with received theory because when there are subscription prices the ad level is independent of the number of firms (Anderson and Coate, 2005).

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platform has a "monopoly bottleneck" position over advertising to its own viewers, and the latter means that attention spans are unlimited.

In this short paper, we explore two potential avenues that can reverse the results of standard models and help to reconcile theory with empirical findings. We also argue that introducing competition for advertisers can imply that mergers reduce media differentiation, which is in sharp contrast to the received wisdom following Steiner (1952). We first sketch how Anderson and Peitz (2011) introduce competition for advertisers by allowing for advertising congestion of viewers who mix between channels. Competition for limited consumer attention brings direct competition between platforms for advertisers. In contrast to the standard predictions, a merger between ad-financed platforms reduces ad levels and increases ad prices. The reason is that a merged firm internalizes more the congestion problem. Conversely, more platform entry has the opposite effect because congestion is internalized less with a larger overall congestion level.

The presence of multi-homing viewers also generates competition for advertisers. To highlight this property, Anderson and Peitz (2011) assume that advertisers are willing to pay nothing for a second impression with a viewer who has already been reached. Competing platforms can then charge advertisers only for viewers they deliver exclusively. Anderson and Peitz (2011) term this the Principle of Incremental Pricing. However, two merging platforms can charge advertisers for viewers who visit both platforms. If some viewers multi-home, a merger will consequently raise the price per ad even if the total number of viewers stays constant. Again, the result contrasts with the predictions of the standard models of media economics. Competition for advertisers due to multi-homing viewers may also alter the standard prediction that a merger among ad-financed platforms leads to more program diversity. The reason is that while competing ad-financed platforms have incentives to attract exclusive viewers through differentiation, a shared viewer has the same value for merged platforms as an exclusive viewer.

The rest of the paper is organized as follows. In Section 2 we present the standard model without competition for advertisers, following the lines of Anderson and Coate (2005). The advertising congestion framework is introduced in Section 3, while the consequences of multi-homing viewers for advertising competition are discussed in Section 4. Section 5 provides some concluding remarks.

2. Backdrop

Consider n platforms that provide program content to attract viewers. They deliver these eyeballs to advertisers. Advertising revenue is the sole source of finance to platforms, and advertisers are assumed to be price takers (so there is no bargaining over prices). Platform i's profit is thus $\pi_i = P_i a_i$, $i = 1, \ldots n$, where P_i is the price per ad and a_i is the number of ads aired. We shall shortly break this profit down to break out the role of viewer demand.

Content is attractive to viewers, but the embodied ads are a nuisance. Under the standard assumption, viewers are assumed to be annoyed by ads, so that nuisance is the "price" to viewers from watching. Viewers' tastes over platforms are differentiated. Assume that each viewer makes a discrete choice over which platform to watch, corresponding to a single-homing assumption on viewers. Let then $N_i(a_i, \mathbf{a}_{-i})$ be the number of viewers (demand) for platform i as a function of its ad level and the vector of ad levels, $\mathbf{a}_{-i}$, of its competitors. The functions $N_i(.)$ are then just like those of a standard discrete choice (substitute products) demand system, decreasing in own advertising, and (weakly) increasing in the advertising level of each rival.

On the advertiser side, assume that there is no advertising clutter, so that all ads on a platform are registered by all consumers watching. Furthermore, let advertisers have different willingness to pay for reaching viewers (impressions). Assume that the advertiser's willingness-to-pay for advertising on each platform is a linear function of the number of viewers on the platform, so there are constant returns to reaching prospective customers. This means that targeting by platform is not an issue: viewers on one platform are not inherently more valuable.

Then we can rank advertisers in terms of decreasing willingness to pay per eyeball, from large to small in standard fashion, to generate a demand curve per eyeball. Call this $p(a)$ so that the price per ad is $P = p(a_i)N_i(a_i, \mathbf{a}_{-i})$. Hence, under these assumptions, we can write

$$\pi_i = a_i p(a_i) N_i(a_i, \mathbf{a}_{-i}) \\ = R(a_i) N_i(a_i, \mathbf{a}_{-i})$$

where $R(a_i)$ is the revenue per ad per viewer.[5]

The first-order condition (with ad levels as the strategic variables) is written as

$$\frac{R'(a_i)}{R(a_i)} = \frac{-N_i'(a_i, \mathbf{a}_{-i})}{N_i(a_i, \mathbf{a}_{-i})} \quad (1)$$

which says (equivalently) that the elasticity of revenue per viewer should equal the viewer demand elasticity. In this we recognize a variation on the standard elasticity condition for oligopoly pricing. Indeed, consider the (Bertrand) oligopoly problem of

$$\max_{p_i} \pi_i = (p_i - c_i) N_i(p_i, \mathbf{p}_{-i}).$$

where now $N_i(p_i, \mathbf{p}_{-i})$ is the demand addressed to firm i and p_i is (temporarily) the price i sets for its product, while c_i is its marginal cost (and $\mathbf{p}_{-i}$ is the vector of other firms' prices). Then the first-order condition sets

$$\frac{1}{(p_i - c_i)} = \frac{-N_i'(p_i, \mathbf{p}_{-i})}{N_i(p_i, \mathbf{p}_{-i})} \quad (2)$$

which, in elasticity form, gives the inverse elasticity (Lerner) rule for pricing. The parallels are now easily developed. First, from Eq. (2), lower prices result (because $1/(p_i - c_i)$ decreases in p_i) when the equilibrium value of $-N_i'(p_i, \mathbf{p}_{-i})/N_i(p_i, \mathbf{p}_{-i})$ increases following a change (in, say, the number of platforms, n). Likewise, from Eq. (1), as long as $R'(a)/R(a)$ is decreasing in a (which holds under the weak condition that $lnR(a)$ be concave), then lower ad levels result whenever the equilibrium value of $-N_i'(a_i, \mathbf{a}_{-i})/N_i(a_i, \mathbf{a}_{-i})$ increases.

Consider first the effects of entry of platforms at a symmetric equilibrium: under regular conditions, the right-hand side expressions of Eqs. (2) and (1) decrease. For example, in the case of the Vickrey–Salop circle model we have

$$\frac{-N_i'(a^*, \mathbf{a}^*)}{N_i((a^*, \mathbf{a}^*))} = \frac{n}{t},$$

where the transport parameter t measures the degree of platform differentiation. For the logit (see Anderson et al., 1992) this ratio is $(n-1)/(\mu n)$, where the taste variance parameter μ measures the degree of platform differentiation in the multinomial logit. Both expressions are increasing in n. In the differentiated products context, this means simply that more competition leads to lower prices. Transposing this result to the media economics context, entry leads to lower equilibrium ad levels. The reason is that competition for viewers plays out as competition in nuisance levels (both price and ad levels are nuisances). More competition reduces the equilibrium nuisance level. The lower equilibrium level of ads implies a higher equilibrium price per viewer per ad, as we move back up the per viewer advertiser demand curve.

[5] We have included here no costs: it suffices that the costs of screening ads are the same as those for programs, so the cost of an hour of programming is independent of its composition.

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Consider next the effects of a merger. In the price-competition version of the differentiated products model, a merger leads the merging firms to raise prices, as they internalize the cross-substitution in demand to the sibling product. Under strategic complementarity of prices, rivals follow suit, giving the merged firms a further fillip to raise prices (see Deneckere and Davidson, 1985). Transposing these results to the media economics context, a merger leads to higher equilibrium ad levels across the board. Correspondingly, from the demand function per ad per viewer, prices per ad per viewer fall under merger. If viewer numbers contract as ad levels rise, ad prices fall from the twin effects of fewer viewers, and lower price per ad per viewer.

3. Advertising congestion

Anderson and de Palma (2009) analyze information congestion by assuming that consumer attention spans are limited, so consumers can only process and register some, but not all, of the advertising messages to which they are exposed. The analysis considers "open access" to attention (for example, through billboards, or bulk mail) and deploys an analysis of attention as a common property resource, so access restriction by platforms is not considered.

Anderson and Peitz (2011) bring this approach full square into media economics by analyzing oligopoly platforms choosing how much to advertise while taking into account the effects on overall attention.[6] This implies that the free-rider congestion problem is internalized more by larger platforms.

To see how this works for introducing competition for advertisers, consider first the situation with an invariant amount of time spent by a representative viewer on each platform (so there is no advertising nuisance yet: this is treated below).

Let λ_i be the amount of time spent on platform $i=1, \ldots, n$ and let λ_0 be the time spent not watching (the outside option), and normalize the total time available to 1, so that $\sum_{i=0}^{n} \lambda_i = 1$. If platform i airs a_i ads, then there are two conditions that must be satisfied for an ad to communicate successfully with a viewer. First, the viewer must be on the platform when the ad is aired. This happens with probability λ_i (assuming that ads are uniformly distributed over the time segment). Second, the viewer must register the ad even if it is seen. The idea here is that attention is limited: suppose a fixed number φ of ads seen are registered. In sum, then, the chance of registering a given ad on platform i is φ/A, where $A = \sum_{j=1}^{n} \lambda_j a_j$ is the expected total number of ads seen.

On the advertiser side, we again rank them in decreasing order of willingness to pay to contact prospective customers, so that they are willing to pay $p(a)$ if they make contact and break into the viewer's attention span. With congestion, the willingness to pay becomes $p(a)\varphi/A$, where A ads are seen by the viewer but only φ are retained.

Thus, if there are a_i ads on platform i, the ad price is the willingness to pay of the marginal advertiser, i.e., $p(a_i)\varphi/A$. Now we have platform i's problem as

$$\max_{a_i} a_i p(a_i) \frac{\varphi}{A} \lambda_i = R(a_i) \frac{\varphi}{A} \lambda_i, \quad i = 1, \ldots, n.$$

Notice that platform interdependence comes from the joint assumption that the A ads are seen across multiple channels (so viewers are mixing) and that there is advertising congestion.[7] Note that if φ were to exceed A then there would be no congestion, and no interdependence across platforms for advertisers. Then ad levels per platform would be simply the "monopoly" level (i.e., an ad level satisfying $R'(a_i) = 0$, independently of λ_i), and there would be no n effect.

Consider a symmetric situation, i.e., $\lambda_i = \lambda$ for all $i \in \{1, \ldots, n\}$, with common equilibrium ad level a . This ad level satisfies the first-order condition.

$$R'(a^*) \frac{\varphi}{A} - R(a^*) \frac{\varphi}{A^2} \lambda = 0$$

Hence, noting that the equilibrium value of A is $n\lambda a$, this becomes

$$\frac{a^* R'(a^*)}{R(a^*)} = \frac{1}{n}.$$

The left-hand side is a decreasing function of a under the standard condition that ln $p(a)$ is concave.[8]

This implies that a now increases with n. The intuition is that the smaller the number of firms the more they internalize the congestion externality, so that more firms leads to more ads. Consequently, the price per ad per viewer-hour falls. The price per ad falls for that reason and because the amount of time spent on each platform (λ) falls.

The merger analysis follows along similar lines. A common owner of two platforms internalizes the congestion externality to a greater extent than do independent platforms, because it recognizes the beneficial spill-over on its sibling platform. The lower resulting ad level causes other platforms to become relatively larger participants in total ads, and so they have a greater incentive to reduce ad congestion as well. Consequently, prices per ad per viewer-hour rise, moving up the advertiser demand curve. Insofar as lower ad levels would encourage viewers, the price per ad rises.

The above analysis treated viewer behavior as exogenous. Anderson and Peitz (2011) introduce nuisance as a factor determining viewer choice of how much time to spend on each competing platform by postulating a CES form for viewing utility, with a quality time formulation. They write $s_i(1-a_i)$ as the quality-time per platform. Here, s_i is seen as the program quality. This utility is maximized under a time constraint to generate time demands per platform as a function of ad nuisance. Programs are horizontally differentiated, augmented by vertical differentiation via the qualities s_i. Similar comparative static properties hold regarding the effects of entry and mergers.

4. Multi-homing viewers

In the analysis in the previous section, congestion clutter drives the interaction between platforms in their competition for advertisers. The complementary research in ~~Anderson and Peitz (2011)~~ – henceforth AFK – closes down the congestion effect, and emphasizes viewer heterogeneity by having some viewers visit more than one platform. Multi-homing is thus the crucial element in their approach.[9]

In contrast to the model in Section 3, AFK assume that the strategic variable is the price per ad.[10] To emphasize the key differences in competition when allowing for multi-homing viewers, they initially abstract from viewer nuisance effects and assume that there is a fixed number of viewers on each platform. They further suppose that there is no benefit from reaching the same viewer more than once (an analogous assumption is made by Athey et al., 2011).[11]

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[6] Rysman (2004) notes that congestion effects can affect the demand for advertising, although he does not draw out the effects of competition for attention across platforms.

[7] The mixing of programs by itself does not affect the results of the standard model (see e.g. Peitz and Valletti (2008)).

[8] To see this, note that $\frac{a^* R'(a^*)}{R(a^*)} = 1 + \frac{p'(a^*)a^*}{p(a^*)}$, and the elasticity term is decreasing in a^* when $pp'' - (p')^2 < 0$, which is the condition for In p to be strictly concave.

[9] Credit is due to Ambrus and Reisinger (2007) for recognizing the importance of the single-homing assumptions, and modeling a two-sided market structure with endogenous multi-homing viewers.

[10] Crampes et al. (2009) consider the price version of the Anderson and Coate (2005) model.

[11] All that is needed for the main results is that the value of a second impression is less than that of a first one.

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This will serve to highlight the property that advertising prices might increase subsequent to a merger between two media platforms.

We shall now let λ_i denote the number of viewers on platform *i* (rather than the time each viewer spends at the platform, as in the previous section), and assume that each ad on platform *i* is seen by all viewers on that platform. Furthermore, let *b* denote each advertiser's willingness to pay per ad impression, and assume that the number of advertisers is fixed at *A*. Then, if *i*'s viewers are all exclusive to its platform, *i* can set a price per ad of $b\lambda_i$ and post *A* ads.

Now suppose that some of *i*'s viewers are also shared with platform *j* (and only platform *j* for the moment). The number of exclusive viewers of platform *i* is defined as $\lambda_i^e = \lambda_i - \lambda_{ij}$, where λ_{ij} is the number of overlapping viewers of platforms *i* and *j*. Then the equilibrium ad price on platform *i* is $b\lambda_i^e$, so that *i* can only charge for its exclusive viewers. To see this, notice that at such prices advertisers will post ads on both platforms. A higher price will net no advertisers, a lower one will gain no advertisers. This property is termed by AFK the Principle of Incremental Pricing, and constitutes a natural converse to the standard Bertrand pricing result.

AFK extend this result to allow for advertising nuisance on the viewer side in the following way. Let the number of exclusive consumers on a platform fall with the number of ads on the platform. Viewers rationally anticipate ad levels when deciding which platform(s) to join, while platforms and advertisers rationally anticipate viewer numbers. Platforms set prices per ad, and advertisers choose where to place ads. AFK show that there exists a unique (pure strategy) equilibrium in which each platform sets a price per ad equal to *b* times the number of exclusive viewers per platform.[12] Each advertiser places an ad on each platform, and hence each platform is able to extract in price from advertisers only the value of the exclusive consumers it delivers. This incremental pricing property extends readily to several platforms.

We now turn to the implications for entry and mergers. Entry eats away at platforms' fixed bases of exclusive viewers, and therefore reduces the price per ad. In this simple formulation the price per ad per exclusive viewer remains *b*. However, the price per ad per actual viewer falls because of the larger number of actual viewers relative to exclusive ones.[13]

A merger between two platforms renders exclusive to the joint platform those viewers in the intersection of the platforms. Before the merger, viewers common to the merging parties cannot be charged for in equilibrium, but after merger, they can (provided they are not on other platforms too). This implies that ad prices rise with a merger. In addition, analogous to the discussion above for entry, the average price per ad per viewer will also rise.

Allowing for multi-homing viewers (and a lesser value of a second impression) also yields new insight into platforms' incentives to differentiate. Ad-financed platforms chase exclusive viewers, and so competing ad-financed platforms will want to differentiate to attract more exclusive viewers. This contrasts with the classic duplication result of Steiner (1952), and it contrasts with his prediction that a merger between ad-financed platforms will lead to more diversity. Because platforms only benefit from exclusive consumers, their tastes will affect platforms' programming choices, while the tastes of multi-homing viewers are ignored.

One major shortcoming of the model outlined above is that all advertisers have the same valuation per viewer (*b*). In AFK, the analysis is extended to the case of heterogeneous advertisers. On the consumer side, AFK use a specific horizontal differentiation model of viewer choice, namely that in Anderson et al. (2010). This appends a multi-homing choice to the Hotelling-model, and allows different individuals to choose different options. Individuals "in the middle" of the Hotelling line will be most likely to choose two options.[14] On the advertiser side, AFK's model is based on Gabszewicz and Wauthy (2003). Effectively, advertisers with the highest willingness to pay for contacting viewers will multi-home, the next tranche will advertise on the platform delivering more viewers, and those at the very bottom will not advertise at all.

AFK put these two sides together with platform competition, assuming platforms directly set prices per ad as their strategies. Their focus is not on mergers *per se*, but rather on the relationship between viewer exclusivity, ad nuisance and platform profitability. One of their most striking results is that two competing platforms might make higher profits the greater is consumer nuisance cost of ads. The intuition for this result, which at first might seem counter-intuitive, is that the more a viewer dislikes ads, the less likely it is that s/he will spend time watching programs on both platforms. The number of exclusive viewers on each platform is consequently increasing in the nuisance cost. Other things equal, this will in turn increase platform profits.[15] This leads us to conjecture that merger incentives may be smaller the greater is the ad nuisance cost. Whether this is true is to be seen in future research.

5. Concluding remarks

Standard media economics theory cannot accommodate the possibility that mergers lower ad levels and raise ad prices, or that entry has the opposite effects. Empirical evidence is mixed, so the unambiguous results from the standard theory suggest that some countervailing forces may be missing. In this paper we have explored the implications of advertising congestion and viewer multi-homing and found that the predictions of the standard theory are reversed.

The two departures from standard theory that we have explored may well fit different media markets, and thus could be seen as complementary (as opposed to competing) explanations. In Anderson and Peitz (2011), access to viewer attention is limited and viewers mix between channels. The model seems well-suited for television and radio insofar as viewers have a fixed amount of time to allocate among channels, and cannot see the ad currently aired on one channel if they are on another at the time the ad is aired. By contrast, in Anderson et al. (2010), multi-homing viewers are fully exposed to the advertising of more than one media platform. This better fits magazines and newspapers, where viewer (or readers) can be exposed simultaneously to the ads of more than one platform.

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[12] This number is determined from the condition that there be *A* ads on each platform.

[13] In this simplified model, the number of ads per platform stays constant at *A*.

[14] Anderson et al. (2010, 2011) consider a duopoly model, but it can readily be extended to cover oligopoly using the Vickrey–Salop circle set-up.

[15] The logic is similar to that underlying the finding of Grossman and Shapiro (1984) that higher advertising costs can increase firms' profits by relaxing price competition through there being less overlap of informed consumers.

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